COCHECO RIVER FLOOD CONTROL

OPERATION AND MAINTENANCE MANUAL

FOR

FLOOD PROTECTIVE WORKS

FARMINGTON, N.H.

COMPLETED PROJECT FROM SO. MAIN ST. BRIDGE

Corps of Engineers, U.S. Army - Office of the Division Engineer

New England Division - Boston, Mass.

FEBRUARY 1957

ARMY-NED-BOSTON

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AT

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FOREWORD

The successful functioning of flood protective works is not assured by construction of a system of adequate dikes and channel widening, deepening and realignment. If the system is to perform the functions for which it was designed, it must be carefully maintained during periods of normal river stages and properly operated during flood periods.

The need for proper maintenance cannot be too highly stressed in view of the fact that large damages may be incurred through failure of a critical element in flood time, caused by deterioration or damage that would have been eliminated by proper maintenance.

Necessary maintenance and proper operation require that responsible local persons have a thorough understanding of the functions of the various units of the system and the best methods of maintaining the system and operating it during flood emergencies. It is the purpose of this manual to provide complete information so that all parties may know their responsibilities in maintaining and operating the flood protection system in accordance with the regulations prescribed by the Secretary of War as amplified by this manual.

The Flood Control Regulations for Maintenance and Operation of Flood Control Works quoted herein were approved by the Acting Secretary of War on 9 August 1944. Upon establishment of the Department of Defense, the improvement of rivers and harbors and other waterways for flood control and other purposes, formerly under the jurisdiction of the Secretary of War, became the responsibility of the Secretary of the Army. Reference therein to the Secretary of War and War Department shall be construed to mean respectively the Secretary of the Army and Department of the Army. Where reference is made to the District Engineer in the Regulations included in this manual, it shall be construed to mean the Division Engineer, New England Division, Corps of Engineers, U. S. Army.

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SECTION I

INTRODUCTION

1-01. AUTHORIZATION. - Construction of a local protection project on the Cocheco River at Farmington, New Hampshire, was authorized by the Chief of Engineers on August 4, 1955 pursuant to authority contained in Section 212 of the Flood Control Act approved May 17, 1950 (Public Law 516 - 81st Congress).

1-02. LOCATION. - The project is located along the Cocheco River in Farmington and extends from the Central Street bridge to the mouth of Dames Brook 2,000 feet below the South Main Street bridge.

1-03. DESCRIPTION OF PROJECT. - The project consists of straightening approximately 600 feet of the Mad River at its confluence with the Cocheco; enlarging and straightening approximately 3,100 feet of the Cocheco River from the Central Street bridge to the South Main Street bridge; construction of approximately 3,000 feet of earth dike and approximately 150 feet of concrete flood wall along the left bank of the Cocheco River between the two bridges; and clearing and snagging the Cocheco River from the South Main Street bridge to the mouth of Dames Brook, a distance of approximately 2,000 feet.

1-04. PROTECTION PROVIDED. - The area protected, comprising approximately 45 acres, is bounded on the north by Central Street, on the east by South Main Street, and on the south and west by the Cocheco River. This area comprises a substantial portion of the center of Farmington. The construction will provide protection to the area from a flood greater than the maximum flood of record in 1936, with three feet of freeboard on the dike and flood wall.

1-05. CONSTRUCTION HISTORY. - Construction of the project was initiated in June 1956 and completed in November 1956. The project was constructed by Rudolph Pepin & Son of Sanford, Maine. The approximately 40,000 cubic yards of material excavated for the new channels of the Mad and Cocheco Rivers were used in construction of the dike. The material removed in connection with snagging and clearing downstream of the South Main Street brdige was sidecast along the banks of the river. The completed project was turned over to the town of Farmington for maintenance and operation on 6 December 1956.

1-06. PLANS. - A reduced size set of plans showing the project as actually constructed is included as Appendix E.

d. Inspections of the dike shall be made during and after periods of high water, as it is at such times that any weak spots will be discovered that might otherwise be overlooked.

4-03. OPERATION. - a. Paragraph 208.10 (b) (2) of the prescribed regulations gives rules for the operation of levees. These rules apply equally to earth dikes and are quoted below. Following these, a few of the points which apply particularly to the Farmington project will be discussed.

"(2) Operation. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

"(i) There are no indications of slides or sloughs developing;

"(ii) Wave wash or scouring action is not occurring;

"(iii) No low reaches of levee exist which may be overtopped;

"(iv) No other conditions exist which might endanger the structure.

"Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section."

b. Operation as referred to the use of the dike may be at a time of moderate high water, such as a spring freshet, or may be when unusual conditions indicate the possibility of dangerous flood heights. Floods on the Cocheco River do not give much time in which to make extensive preparations. Prompt action in starting work is, therefore, of utmost importance.

c. Patrolling the dike depends on the depth of water against the riverside slope. Stages in this manual refer to depth of water above channel bottom, as constructed; elevations refer to mean sea level datum. For reference, the top of the concrete guardrail on the South Main Street bridge is elevation 275.7; the top of the concrete guardrail on the Central Street bridge is elevation 289.6.

(1) Patrolling the dike should start when the water reaches a stage of 5.5 feet (elevation 265.0) at the upstream face

SECTION III

GENERAL REGULATIONS

3-01. PURPOSE OF THIS MANUAL. - The purpose of this Manual is to present detailed information to be used as a guide in complying with "Flood Control Regulations - Maintenance and Operation of Flood Control Works" as approved by the Acting Secretary of War on 9 August 1944, and published in this volume as Appendix A. In executing assurances of local cooperation, the Town has agreed to maintain and operate the completed works in accordance with those regulations. The regulations are intended to cover all local protection projects constructed by the Department throughout the United States, are general in nature, and obviously cannot give detailed instructions for the maintenance and operation of a specific project. The details set forth in this Manual for maintenance and operation of the Farmington project are intended to supplement the regulations to permit obtaining all the benefits and protection against floods for which the project was designed. Failure to maintain and operate the project as required by the regulations and as detailed herein can cause severe property losses and loss of life and can result in an irreparable loss of confidence in the flood protection system by citizens who have invested their funds on the basis of the protection which it provides.

3-02. GENERAL RULES AND REGULATIONS. - Paragraph 208.10(a) of the regulations prescribed by the Secretary of War gives general rules for the maintenance and operation of structures and facilities constructed by the United States for local flood protection. Applicable portions are quoted below to avoid the necessity for cross reference and are further defined by remarks under each quotation.

"(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits."

(a) These requirements cannot be overstressed, and the Town authorities must make adequate provisions for funds, personnel, equipment, and materials to allow for the proper maintenance and operation of the flood protective works.

"(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the

'Superintendent,' who shall be responsible for the development maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States."

(a) The committee should be composed of competent members, preferably men experienced in engineering or construction work of a nature similar to the flood protection works. The committee must be given broad authority to carry out its responsibilities. The name, address, and office and home telephone numbers of the Superintendent, and any changes thereof, shall be promptly furnished the Division Engineer.

"(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times."

(a) Approximately 1,000 sand bags and tools such as picks and shovels for 10 men should be obtained and held in reserve to meet any ordinary emergency that may occur during flood periods. Borrow pits for embankment materials should be secured and sources of where to obtain additional supplies of materials, tools, and equipment should be well established in order that these articles can be obtained quickly in case of an emergency.

"(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities."

(a) The grazing of cattle, disposal of rubbish, erection of fences, or barriers, wearing of footpaths or any form of trespassing on the project shall be prohibited.

"(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representatives that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning

of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work."

(a) Any contemplated improvements or alterations as outlined above must be submitted to the Corps of Engineers, Boston, Mass., and the approval of the Division Engineer obtained prior to the Town authorizing the work. All requests for approval shall be in writing and complete drawings in duplicate, one set of which shall be in reproducible form, must be submitted along with a full description of the work intended. The Town will be held responsible for obtaining prior approval from the Corps of Engineers for any improvements or alterations proposed by itself, private parties or any public parties. The Town shall furnish the Division Engineer as-built drawings in duplicate of the completed work.

"(6) It shall be the duty of the superintendent to submit a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works."

(a) See Paragraph 3-05 of this manual for instructions on submitting reports.

"(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works."

(a) The Division Engineer or his representatives will make periodic inspections of the protective works to determine if the project is being properly maintained and operated by the Town.

"(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made."

(a) The Town should maintain the facilities and keep them in good repair and not wait for the Division Engineer to call such matters to its attention. Upon request, the Division Office will advise the Town how to make any major repairs to the facilities.

"(9) ----------Not applicable----------"

"(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or

separate useful part thereof, to assist them in carrying out their obligations under these regulations."

(a) The flood control committee should familiarize itself with the contents of this manual. The Town authorities are encouraged to call on the Division Office of the Corps of Engineers for any additional advice or instructions required by them in carrying out the Town's obligations for maintaining and operating the flood protection facilities.

3-03. MAINTENANCE. - a. Maintenance in this manual refers to the care and upkeep of the completed construction work which was turned over to the Town. The War Department, through its Division Engineer, endeavored to design the safest system possible, and to see that it was well constructed. If the work is neglected, there will be deterioration and possible failure in flood time when there is dire need of dependable protection.

b. The organization which is responsible for maintenance should always give thought to what it will do when the need arises to operate. From experience gained through maintaining the different parts of the system, it will be in a position to use them effectively in time of stress.

c. Maintenance involves regular inspection of the entire system. The purpose of the inspection is to detect any deterioration or faulty operation that needs repair.

d. Each of the major features of your project will be discussed separately with respect to the points that should be watched, as developed through the use of similar structures over a long period of years.

3-04. OPERATION. - Operation in this manual refers to the actual use of the various features of the protection works during flood periods of the river. It is intended that the procedure outlined herein will be sufficient to insure protection from floods to the design stage. However, advice relative to operation may be secured at any time from the Engineering Division of the New England Division Officer.

3-05. REPORTS. - a. The regulations prescribed by the Secretary of War call for semi-annual reports to be submitted by the Superintendent to the Division Engineer, covering inspection, maintenance and operation. Inspection of the flood protective facilities shall be made immediately prior to flood seasons, immediately following floods, and otherwise at intervals not exceeding 90 days as required by the regulations.

(1) Whereas spring is the season in which the majority of floods have occurred, floods can occur in any month of the year.

b. To assist the superintendent in making his inspections and reports, a sample form has been prepared and is included in Appendix C. The superintendent shall have additional copies printed for use in submitting his reports.

c. The semi-annual reports should be submitted in triplicate to the Division Engineer each February and August. The reports will be submitted in letter form with copies of the inspection forms covering the inspections made during the period of the report. The reports shall cover the following points:

(1) A description of the maintenance work performed in the preceding six months.

(2) The number and classification of men working on maintenance, regularly and intermittently.

(3) Description of any work performed by contract on the repair or improvement of the project.

(4) Description of use or operation of the system during the period being reported.

(5) Suggestions relative to public cooperation and comments concerning public sentiment on the protection obtained are considered pertinent and desirable data for inclusion in the report, but such data are not required.

SECTION IV

DIKES

4-01. DESCRIPTION. - The dike constructed by the Corps of Engineers extends along the left bank of the Cocheco River from approximately 200 feet downstream of the Central Street bridge to the South Main Street bridge. The dike, constructed of materials from channel excavation, in general has a top width of 10 feet and minimum side slopes of 1 on 2-1/2. The top elevation has been built to such height as to provide at least three feet of freeboard during a flood equal to the estimated flood of record on the Cocheco River. Details of the dike are shown on the plan and cross-sections included as Appendix E.

4-02. MAINTENANCE. - a. Paragraph 208.10 (b) (1) of the prescribed regulations gives rules for the maintenance of levees. These rules apply equally to earth dikes, and applicable portions are quoted below. Following this, a few of the points that apply particularly to the Farmington project are discussed.

"Levees. - (1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, to exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

"(i) No unusual settlement, sloughing or material loss of grade or levee cross section has taken place;

"(ii) No caving has occurred on either the landside or the riverside of the levee which might affect the stability of the levee section;

"(iii) No seepage, saturated areas, or sand boils are occurring;

"(iv) ----------(Not applicable)---------

"(v) Drains through the levees and gates on said drains are in good working condition;

"(vi) No revetment work or riprap has been displaced, washed out or removed;

"(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

"(viii) Access roads to and on the levee are being properly maintained;

"(ix) Cattle guards and gates are in good condition;

"(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

"(xi) There is no unauthorized grazing or vehicular traffic on the levees;

"(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

"Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent."

b. Any unusual settlement, sloughing or caving should be corrected to restore the original dike grades. No major repair work shall be made without prior approval of the Division Engineer, in order that such repairs that may be necessary will not adversely affect the functioning of the protective facilities.

c. Whereas the landside slopes of the dike were topsoiled but not seeded, the superintendent shall encourage the growth of vegetation in order to minimize the damage from erosion and scour caused by surface runoff. Once established, the vegetation shall be mowed at regular intervals.

d. Inspections of the dike shall be made during and after periods of high water, as it is at such times that any weak spots will be discovered that might otherwise be overlooked.

4-03. OPERATION. - a. Paragraph 208.10 (b) (2) of the prescribed regulations gives rules for the operation of levees. These rules apply equally to earth dikes and are quoted below. Following these, a few of the points which apply particularly to the Farmington project will be discussed.

"(2) Operation. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

"(i) There are no indications of slides or sloughs developing;

"(ii) Wave wash or scouring action is not occurring;

"(iii) No low reaches of levee exist which may be overtopped;

"(iv) No other conditions exist which might endanger the structure.

"Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section."

b. Operation as referred to the use of the dike may be at a time of moderate high water, such as a spring freshet, or may be when unusual conditions indicate the possibility of dangerous flood heights. Floods on the Cocheco River do not give much time in which to make extensive preparations. Prompt action in starting work is, therefore, of utmost importance.

c. Patrolling the dike depends on the depth of water against the riverside slope. Stages in this manual refer to depth of water above channel bottom, as constructed; elevations refer to mean sea level datum. For reference, the top of the concrete guardrail on the South Main Street bridge is elevation 275.7; the top of the concrete guardrail on the Central Street bridge is elevation 289.6.

(1) Patrolling the dike should start when the water reaches a stage of 5.5 feet (elevation 265.0) at the upstream face

of the South Main Street bridge or a stage of 3.5 feet (elevation 276.0) at the downstream face of the Central Street bridge, at which time thorough examinations should be made at intervals of not more than two hours. As the water rises, the interval between examinations should be shortened until the water reaches a stage of 8.0 feet (elevation 267.5) at the South Main Street bridge, or a stage of 5.5 feet (elevation 278.0) at the Central Street bridge, at which time the dikes should be examined at half-hourly intervals, with special watchmen being assigned, if necessary, at places which might become dangerous. Patrolling should continue until the flood has reached its peak and receded below stages of 5.5 feet and 3.5 feet (elevations 265.0 and 276.0) respectively at the South Main Street and Central Street bridges.

(2) Patrolmen should be thoroughly instructed as to their duties, what they are to watch out for, and the exact limits of their beat. On each journey of inspection they should carefully examine both slopes of the dike for seepage or wetness on landside slope, sand boils on landside of dike, wave wash or scouring on riverside slope, and indications of slides or sloughs on either slope.

(3) All unauthorized traffic on the dike should be stopped at once, and patrolmen should be instructed to keep people off the dike unless they can show passes or credentials authorizing their presence.

(4) Plans should be made for a system of one-way traffic on the dike in time of flood for trucks bringing in supplies that may be needed. In the event that materials are urgently needed at a point, trucks can be routed both ways and after depositing their loads driven down the landside slope.

4-04. EMERGENCY REPAIR MEASURES. - a. Scours. - Careful watch should be maintained over stretches of the dike where scouring is likely to occur, particularly at curves in the alignment where the dike is subject to heavy currents, and the dike opposite the mouth of the Mad River. If any indication of scouring is observed, soundings should be taken to observe the amount and progress of the cour. Sandbagging or dumped rock will generally afford the most practicable means of combatting this condition. The open ends of sandbags so used must be sewed or tied after filling with earth.

b. Wave wash. - Dikes may be subjected to wave wash on broad reaches of water even though the direct action of high wind is impeded by natural barriers such as trees. Well-sodded slopes will usually withstand waves from a storm of about an hour's duration without serious damage. An attack over a longer period may

become serious and the slopes should be protected by sacking or equivalent protection. Extent of washes can be observed by wading along the attacked slope. Sandbags should be placed in the erosions in as effective a manner as possible, carrying the protection well above the action of the waves. Sandbags used for this purpose require only about one-half cubic foot of material and should be sewed or tied. The aim is to obtain a maximum of coverage with only sufficient weight to hold the sack in place.

c. Sand Boils. - (1) General. - A sand boil is the result of a transfer of pressure head and seepage from the river through a pervious stratum near or at the surface to the landside of the levee. This seepage under pressure tends to push its way to the surface and actually floats the material through which it flows. No harmful effect results provided the weight of the relatively impervious soil layer overlying the pervious stratum, in which the flow under pressure is occurring, is sufficient to counterbalance this pressure. When the soil stratum overlying the pervious layer is insufficient to counterbalance the upward pressure or when no such stratum exists, boils break through the surface on the landside wherever these weaknesses are present. The sand boil may discharge relatively clear water or the discharge may contain quantities of sand and silt, depending upon the magnitude of the pressure and the size of the boil.

(2) Effects of Sand Boils. - Sand boils can produce three distinctly different effects on the levee, depending upon the condition of flow under the levee. These three effects are illustrated in Appendix D. In Figure 1, Plate No. I, the seepage flow develops a definite pipe or tube under the levee. This breaks out at the landside toe in the form of one or more large sand boils. Unless checked, this flow causes a cavern to be developed under the levee, resulting in subsidence of the levee and subsequent overtopping. This case can be most easily recognized by slumping of the levee crown. Figure 2, Plate No. I, illustrates the case where seepage flows under pressure under the levee without following a defined path, as was the case above. This flow results in one or more boils outcropping at or near the landside toe. The flow from these boils tends to undercut and ravel the slope, resulting in a sloughing of the slope. Evidence of this type of failure is found in undercutting and ravelling at the landside toe. Figure 3, Plate No. I, shows a third type of effect of a sand boil. In this case, numerous small boils, many of which are scarecely noticeable, outcrop at or near the toe. While no boil may appear to be dangerous in itself, the consequence of the group of boils is to cause floatation of the soil, thereby reducing the shearing strength of the material at the toe, where maximum shearing stress occurs, to such an extent that failure of the slope through sliding results.

(3) General Instructions for Handling Sand Boils. - All sand boils shall be watched closely. All boils shall be marked conspicuously with flagging so that patrols can locate them without difficulty and observe changes in their condition. A sand boil which discharges clear water in a steady flow is usually not dangerous to the safety of the levee. The only action necessary in this case is to drain the excess water off to prevent it from standing near the levee. However, if the flow of water increases, and the sand boil begins to discharge material, corrective action shall be undertaken immediately.

(4) Method of Treatment. -

(a) The accepted method of treating sand boils is to construct a ring of sand bags around the boil, building up a head of water within the ring sufficient to prevent further movement of sand and silt. The accepted method of ringing a sand boil, shown on Plate No. II of Appendix D, is as follows:

1. The entire base of the sack ring is cleared of debris, in order to provide a watertight bond between the natural ground and the sack ring.

2. The sacks are then laid in a ring around the boil, with joints staggered, and with loose earth between all sacks.

3. The ring is carried only to a height sufficient to prevent material from being discharged. The ring should not entirely stop the flow of water, because of the probability of the excessive local pressure head causing additional ruptures of impervious strata and boils nearby.

4. A "V" shaped drain constructed of two boards, or a piece of sheet metal, is then placed near the top of the ring to carry off water.

(b) Actual conditions at each sand boil will determine the exact dimensions of the ring. The diameter and height of the ring depend upon the size of the boil, and the flow of water from it. In general, the following considerations should govern:

1. The base width should be no less than 1-1/2 times the contemplated height.

2. It is well to include weak ground near the boil within the ring, thereby preventing a break through later.

3. The ring should be of sufficient size to permit sacking operations to keep ahead of the flow of water.

(c) Where many boils are found to exist in a given area, a ring levee of sand bags shall be constructed around the entire area and, if necessary, water pumped into the area to provide sufficient weight to counterbalance the upward pressure.

d. Sloughs. - During prolonged high water stages, seeping and sloughing conditions on the back slopes may occur. Such conditions should be observed closely as to progress of seepage up the back slope and the amount of material that is being carried by the water. If the seep velocity becomes great enough to cause, or probably cause, erosion or sloughing of the slope, a sandbag covering should be placed on the seeping area, beginning well out from the toe and progressing up the slope. The covering should extend several feet beyond the saturated area. If the material is obtainable, the affected area should be covered with brush, straw or similar permeable material to a depth of two to four inches before placing the sandbag cover. This will permit the seep water to get away while serving as a filter to prevent loss of earth from the dike. After the covering is placed, close observation should be maintained and additional layers of sandbags placed on the previous ones until the velocity of the seepage is reduced to a point at which the amount of material carried is negligible. Sacking sloughs are illustrated on Plate No. III of Appendix D.

e. Raising existing earth dikes. - In an emergency, time and other conditions permitting, the grade of a dike can be safely raised three feet. The methods most commonly used for this purpose are outlined in the following paragraphs.

(1) Sandbag topping. - The sack ordinarily used for topping an earth dike is a grain or feed sack which holds 100 pounds of grain. Smaller sacks may be used if feed sacks are not available. Grain sacks, filled with about one cubic foot of earth, weighing about 100 pounds, will provide a unit about six inches high, one foot wide and two feet in length.

The sacks may be filled at the source of material and hauled to the dike or filled from stockpile or borrow areas at the dike, conditions determining the method employed. The same is true of filling; i.e., whether power or hand methods are used.

The open end of the sacks should always face upstream or toward the riverside of the dike and need not be sewed or tied. When the sack faces the river the loose end should be folded under and when facing upstream the loose end covered by the succeeding sack.

The front line of sandbags in the first layer should be laid parallel to the dike center line and remaining bags at right angles to the center line. The sandbags in the second layer are all laid at right angles to the center line, the third row similar to the first, etc., as shown on Plate No. IV, Appendix D. All sacks should be lapped about 1/3 each way and well mauled or tramped into place. The sacks should be filled to 2/3 their capacity when flattened out to facilitate proper placing and prevent bursting the sack when mauled or tramped into place.

Plate No. IV illustrates the progressive method of increasing the dike height and gives an approximation of the number of sacks required for dikes of various heights. Plate No. V shows pictures of model sack dike or topping.

A crew of 50 men should fill, carry and place approximately 1500 sacks per eight-hour day, all hand labor, when the source of material is within 150 feet of the point of placement. Production will depend on conditions at the site.

(2) Lumber and Sandbag Topping is the most satisfactory method of raising low reaches of earth dike in emergencies. The chief objection is the time required to install. In putting on this topping, as well as any other topping, a careful line of levels should be run and grade stakes set in advance unless the dike top follows a dependable grade-line. Two-by-four or two-by-six inch stakes should then be driven on the riverside of the crown six feet apart and one-by-twelve inch boards nailed to landside of the stakes. This wall, backed with a single tier of sandbags, will hold out at least one foot of water. If the second foot is necessary, the layers of bags will have to be increased in number and reinforced. Sandbags are laid substantially in the manner described in (1) above. The stakes should be driven at least three feet into the ground, leaving at least three feet out, which will, in extreme cases, hold a three-foot topping if properly braced behind with sandbags. Plate No. VI, Appendix D illustrates this method of raising a dike.

SECTION V

FLOOD WALLS

5-01. DESCRIPTION. - The flood wall constructed by the Corps of Engineers extends approximately 125 feet along the left bank of the Cocheco River from the existing masonry retaining wall at the downstream side of the Central Street bridge to the upstream end of the new earth dike. In addition to the flood wall, a concrete cap was constructed on top of the existing masonry wall to raise it to design grade. The concrete wall is a standard gravity section 1'-6" thick at the top, 7'-0" thick at the base, and varying in height from 10 to 12 feet.

5-02. MAINTENANCE. - Paragraph 208.10 (c) (1) of the prescribed regulations gives rules for the maintenance of flood walls. Applicable portions of these rules are quoted below.

"(c) Flood walls. - (1) Maintenance. - Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) ----------Not applicable----------.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice."

5-03. OPERATION. - Paragraph 208.10 (c) (2) of the prescribed regulations gives rules pertaining to flood walls during periods of flood emergency. These rules are quoted below.

"(2) Operation. - Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall."

5-04. EMERGENCY MEASURES. - a. The Superintendent or responsible members of his organization shall take immediate action to correct any condition which endangers the stability of the wall. All such measures taken will be reported to the Division Engineer immediately after the flood period.

(1) Sand Boils. - See Section IV, paragraph 4-04c for emergency measures to be taken in the event sand boils develop.

(2) Monolith Joints. - Appreciable leakage through vertical monolith joints can be controlled by dumping cinders, sawdust, or similar material on the riverside of the wall. The dumped material will be carried into the joint by the water and plug the leak.

(3) Raising Grade of Wall. - In an extreme emergency, the wall is capable of resisting a head of water one (1) foot above the top of the wall, so that it is possible to raise the wall this amount temporarily by wooden flashboards. One method for constructing temporary flashboards is shown on Plate No. VII of Appendix D.

SECTION VI

DRAINAGE STRUCTURES

6-01. DESCRIPTION. - Drainage structures going through the earth dike or concrete wall are described below.

No.	Size	Type	Use	Station	
1	8"	V.C.	Sanitary sewer	1/79	From C. Card Property
2	12"	V.C.	" & storm	8/11	From A. Card Property
3	12"	V.C.	" " "	8/47	From A. Card Property
4	30"	B.C.C.M.	Field drain	31/00	Upstream of South Main Street bridge

Drains Nos. 1, 2 and 3 are extensions of existing drains and were constructed without gates or head walls. Drain No. 4 is for the purpose of draining the field upstream of South Main Street and is equipped with head walls and flap gate. The flap gate, a 30" Pekrul Model 20 with cast iron frame and flap and bronze hinges, pins, washers, cotter keys, set screws, and lock nuts, was supplied by the Bancroft & Martin Rolling Mills Company of South Portland, Maine.

6-02. MAINTENANCE. - Paragraph 208.10 (d) (1) of the prescribed regulations gives rules for the maintenance of drainage structures. These rules, which are quoted below, are self-explanatory and require no amplification with regard to the Farmington project.

"(d) Drainage structures. (1) Maintenance. - Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stoplog or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, rip-rap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections."

6-03. OPERATION. - Paragraph 208.10 (d) (2) of the prescribed regulations gives rules for operation of drainage structures. These rules, which are quoted below, are further amplified with regard to the Farmington project.

"(2) Operation. - Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of floodwater. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition."

Since there are no flap gates on the outlet ends of drains Nos. 1, 2 and 3, inspections shall be made of the inlet ends during periods of high water to ascertain that they are draining freely and that no backing-up of the line is occurring. If these should be any evidence of backing-up, the inlet should be ringed with a sandbag dike similar to that shown on Plate II in Appendix D, except that the entire ring should be built high enough to equalize the pressure and cause all flow to cease.

SECTION VII

CHANNEL

7-01. DESCRIPTION. - The channel constructed by the Corps of Engineers consists of realignment of the lower 600 feet of the Mad River and enlargement and realignment of the channel of the Cocheco River from the Central Street bridge to the mouth of Dames Brook, approximately 2,000 feet below the South Main Street bridge. The nominal bottom width of the channel is 40 feet with side slopes of 1 on 2-1/2. The bottom of the channel slopes downward from the upstream end of the project at a grade of 0.42% to the South Main Street bridge. Downstream of the South Main Street bridge, the channel slopes downward at a grade of 0.25%.

7-02. MAINTENANCE. - Paragraph 208.10 (g) (1) of the prescribed regulations gives rules for the maintenance of channels and floodways. These rules are quoted below, followed by brief comments on the particular applicability of these rules to the Farmington project.

"Channels and floodways. - (1) Maintenance. - Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth."

(a) All debris and growth which tend to restrict the channel shall be removed promptly. However, care shall be exercised not to disturb the growth of grass or vegetation which tends to stabilize the banks of the channel.

"(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments."

(a) Dumping of waste materials or any types of encroachment on the channel shall be prohibited and prompt steps shall be taken to remove or have removed any such encroachments.

"(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals."

(a) Existence of shoal areas will be apparent from inspections during times of low flow. Shoals under

either span of the South Main Street bridge are particularly undesirable since the capacity of the two spans limits the capacity of the entire channel. Shoal areas should be removed but care should be exercised that slopes of the channel and existing banks are not undercut.

"(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred."

(a) Banks damaged by rain or wave wash or sloughing shall be repaired promptly, using bankrun gravel similar to that used in the dikes.

"(v) ----------Not applicable----------

"(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works."

(a) In order for this project to function properly and as designed, the channel of the Cocheco River downstream from the project must be maintained in such condition that it is capable of carrying flood flows and not cause the river to back up, thus nullifying the effect of the improved channel. This is particularly true of the river channel immediately downstream of the South Main Street bridge.

"Such inspection shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary."

7-03. OPERATION. - Paragraph 208.10 (g) (2) of the prescribed regulations gives rules for operation of channels and floodways. These rules which are quoted below are self-explanatory and require no amplification with regard to the Farmington project.

"(2) Operation. - Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged

against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired."

7-04. EMERGENCY REPAIR MEASURES. - Rules and instructions in paragraphs 4-04 a, b, c and d are equally applicable to emergency repairs of the channel.

SECTION VIII

DRAWINGS AND SPECIFICATIONS

8-01. DRAWINGS AND SPECIFICATIONS. - A complete set of plans and specifications was furnished the Town of Farmington at the time of the construction of the project. A full-size set of plans showing the project as actually constructed was furnished the Town at the time of transmittal of this manual. Reduced prints of these drawings are included in Appendix E.

APPENDIX A

REGULATIONS PRESCRIBED

by the

SECRETARY OF WAR

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

Chapter II—Corps of Engineers, War Department

PART 208—FLOOD CONTROL REGULATIONS

MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1936, as amended and supplemented (49 Stat. 1571; 50 Stat. 877; and 55 Stat. 638; 33 U. S. C. 701c; 701c-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

§ 208.10 *Local flood protection works; maintenance and operation of structures and facilities*—(a) *General.* (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) *Levees*—(1) *Maintenance.* The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) The drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days; and such intermediate times as may be necessary to insure the best possible care of the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) *Operation.* During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) *Flood walls.*—(1) *Maintenance.* Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) *Operation.* Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) *Drainage structures*—(1) *Maintenance.* Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(e) *Closure structures*—(1) *Maintenance.* Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order,

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants*—(1) *Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways* — (1) *Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities* — (1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Regs. 9 August 1944, CE SPEWF)

[SEAL] J. A. ULIO,
Major General,
The Adjutant General.

[F. R. Doc. 44-12285; Filed, August 16, 1944; 9:44 a. m.]

APPENDIX B

ASSURANCES

of

LOCAL COOPERATION

OFFICE OF THE

SELECTMEN

TOWN OF FARMINGTON, NEW HAMPSHIRE

COUNTY OF STRAFFORD

March 10, 1955

United States Army Engineers
857 Commonwealth Avenue
Boston, 15, Mass.

Att: Mr. Slagle

Dear Sir:

The following article of our Town Warrant was adopted at the annual Town Meeting held on March 9th.

Article 21. To see if the town will vote to authorize the selectmen to enter into an agreement with the United States of America, in the event that the proposed local Protection Project, "Cocheco River" is authorized by said United States, said agreement committing the town:

A. To provide without cost to the United States of America, all lands, easements and rights of way, necessary for the construction of the project.

B. To hold and save the United States of America free from damages due to the construction work.

C. To maintain and operate all the works after completion in accordance with regulations prescribed by the secretary of the army.

Very truly yours,

Philip H. Weymouth, Chairman
Board of Selectmen

PHW/t
enc

ASSURANCE

OF THE

TOWN OF FARMINGTON, NEW HAMPSHIRE

WHEREAS, Section 205 of the Flood Control Act approved 30 June 1948 amended by Section 212 of the Flood Control Act approved 17 May 1950 authorizes the Secretary of The Army "to allot from any appropriations heretofore or hereafter made for flood control, not to exceed $3,000,000. for any one fiscal year, for the construction of small flood-control projects not specifically authorized by Congress, and not within areas intended to be protected by projects so authorized, which come within the provisions of Section 1 of the Flood Control Act of June 22, 1936, when in the opinion of the Chief of Engineers such work is advisable: Provided, That not more than $150,000. shall be allotted for this purpose at any single locality from the appropriations for any one fiscal year: Provided further, That the provisions of local cooperation specified in Section 3 of the Flood Control Act of June 22, 1936, as amended, shall apply: And Provided Further, That the work shall be complete in itself and not commit the United States to any additional improvement to insure its successful operation, except as may result from the normal procedure applying to projects authorized after submission of preliminary examination and survey reports."; and

WHEREAS, the Secretary of The Army, under authority of said Section 212 of said Flood Control Act of 1950 approved 17 May 1950 has allotted funds for construction of local protection project on Cocheco River in Farmington, New Hampshire according to plans prepared in the New England Division Office of the Corps of Engineers, United States Army; and

WHEREAS, the construction work is to be prosecuted under the direction of the Secretary of The Army and the supervision of the Chief of Engineers, Corps of Engineers, United States Army; and

WHEREAS, said work of channel improvement is subject to the provisions of Section 3 of the Flood Control Act of 22 June 1936 which provides that no money will be expended on the construction of any project until States, political subdivisions thereof, or other responsible local agencies have given

Assurances to the Secretary of The Army that they will (a) provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the project; (b) hold and save the United States free from damages due to the construction works; (c) maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of The Army; and

WHEREAS, a power line is located within the necessary right-of-way required for the construction;

NOW, THEREFORE, the Town of Farmington, New Hampshire hereby assures the United States as follows:

(a). It will provide without cost to the United States, all lands, easements and rights-of-way necessary for the construction of the project.

(b). It will hold and save the United States free from damages due to the construction works.

(c). It will maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of The Army.

(d). It will arrange for and bear the cost of the relocation of the power line where it interferes with the proposed work.

IN WITNESS WHEREOF, the Board of Selectmen of the Town of Farmington, New Hampshire, acting for and on behalf of said Town of Farmington under authority of Article 21, Town Warrant of 1954 and Article 25, Town Warrant of 1955. have executed the within Assurance and caused the corporate seal of said Town of Farmington to be affixed hereto this 11th day of April, 19 56 .

Signed and Sealed in
Presence of:

Helen J. Tattrie

[signature]

[signature]

TOWN OF FARMINGTON, NEW HAMPSHIRE

BY Hugh H. Weymouth
Selectman

Leon R. Hayes
Selectman

Chester Nickles
Selectman

ACCEPTANCE

22 May 1956

The within Assurance is hereby accepted for and on behalf of the United States of America;

BY Robert J. Fleming Jr.
ROBERT J. FLEMING, JR.
Brigadier General, USA
Division Engineer

APPENDIX C

INSPECTION REPORT FORM

FLOOD PROTECTIVE WORKS
FARMINGTON, NEW HAMPSHIRE
INSPECTION REPORT

FOR PERIOD_____

1. Dike

a. Date inspected by Superintendent _____
b. Condition of slopes and top _____
_____
c. Are there any burrowing animal holes in dike? _____
d. Public use of dike
(1) Are there any paths on dike? _____
(2) Has right-of-way been used for dumping or storage of materials? _____
e. Describe deficiencies, including location, and corrective measures planned. _____
_____
_____
_____

2. Flood Wall

a. Date inspected by Superintendent _____
b. General condition of wall _____
_____
c. Any evidence of surface deterioration? _____
d. Any development of cracks? _____
e. Any evidence of movement or settlement of wall? _____
f. Any cracking of spalling of concrete at joints? _____
g. Are joints well filled with mastic? _____
h. Describe deficiencies, including location, and corrective measures planned _____
_____
_____
_____

3. Channel

a. Date inspected by Superintendent _____
b. General condition of channel _____
c. Has the capacity of the channel been reduced due to growth of vegetation, shoaling, or other encroachments? _____
d. Describe deficiencies, including location, and corrective measures planned _____

_____
_____
_____

4. General

a. Have all deficiencies noted in previous Inspection Report been corrected? _____
b. Has any high water been experienced since the last Inspection Report? _____
If so, describe briefly, including dates, height of water, and effect on protective works. _____

_____
_____
_____

Submitted:

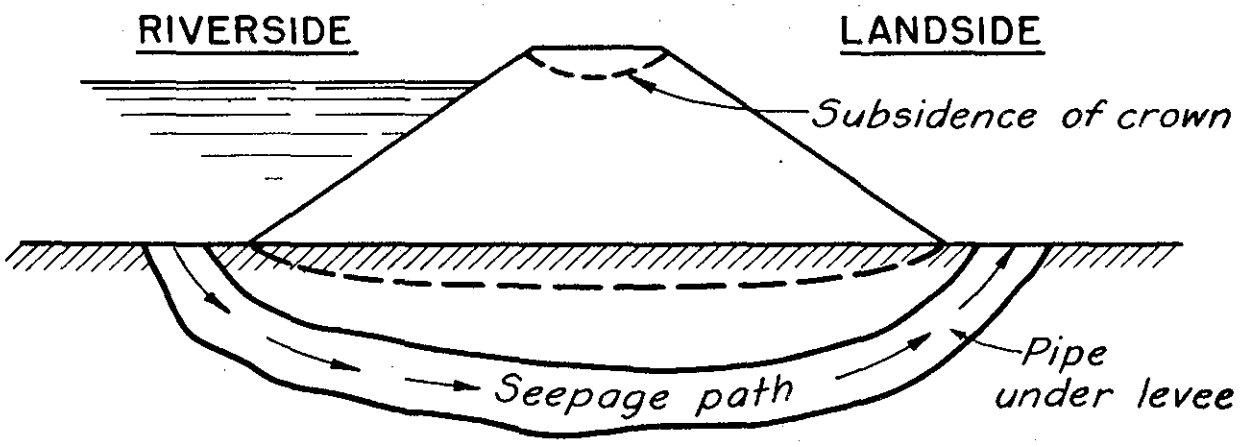
(Signed)_____
Superintendent

_____
(Date)

APPENDIX D

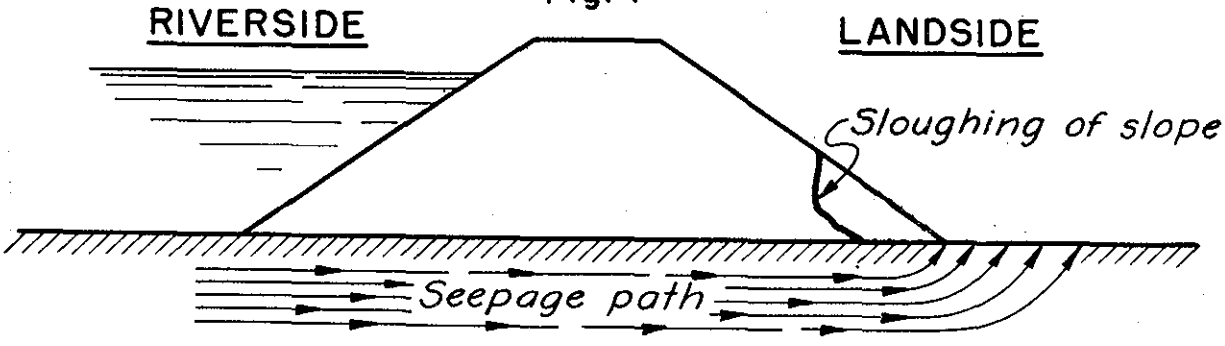
FLOOD EMERGENCY MEASURES

Title	Plate No.
Effects of Sand Boils on Levee	I
Sand Boil	II
Sacking Sloughs	III
Sack Dike or Topping	IV
Model Sack Dike or Topping	V
Lumber and Sack Topping	VI
Emergency Flashboards	VII



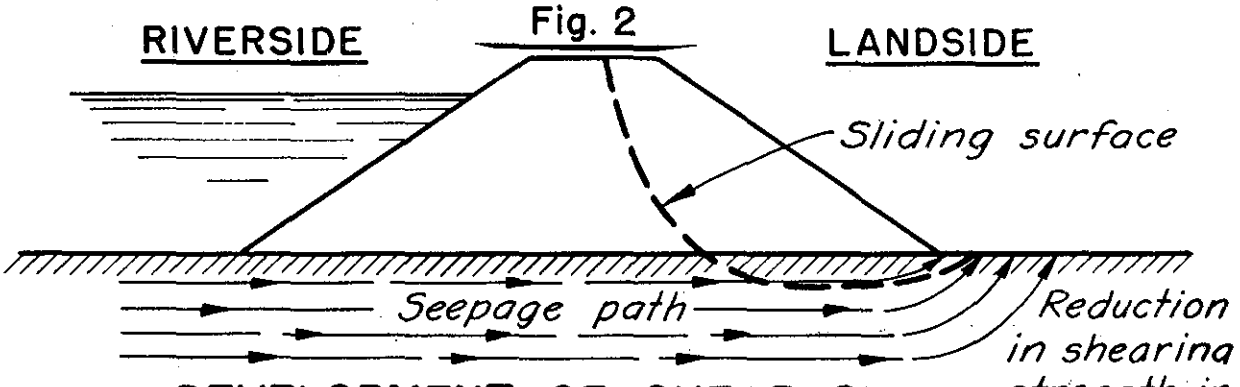
DEVELOPMENT OF PIPE UNDER LEVEE

Fig. 1



SLOUGHING OF LANDSLIDE SLOPE DUE TO RAVELLING AND UNDERCUTTING OF TOE

Fig. 2



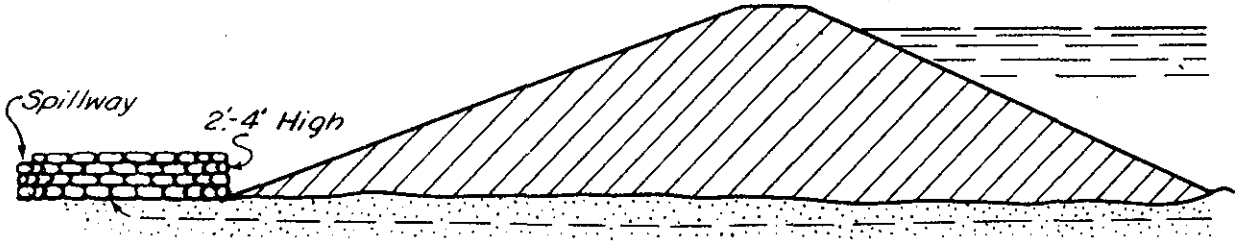
DEVELOPMENT OF SHEAR SLIDE

Fig. 3

EFFECTS OF SAND BOILS ON LEVEE

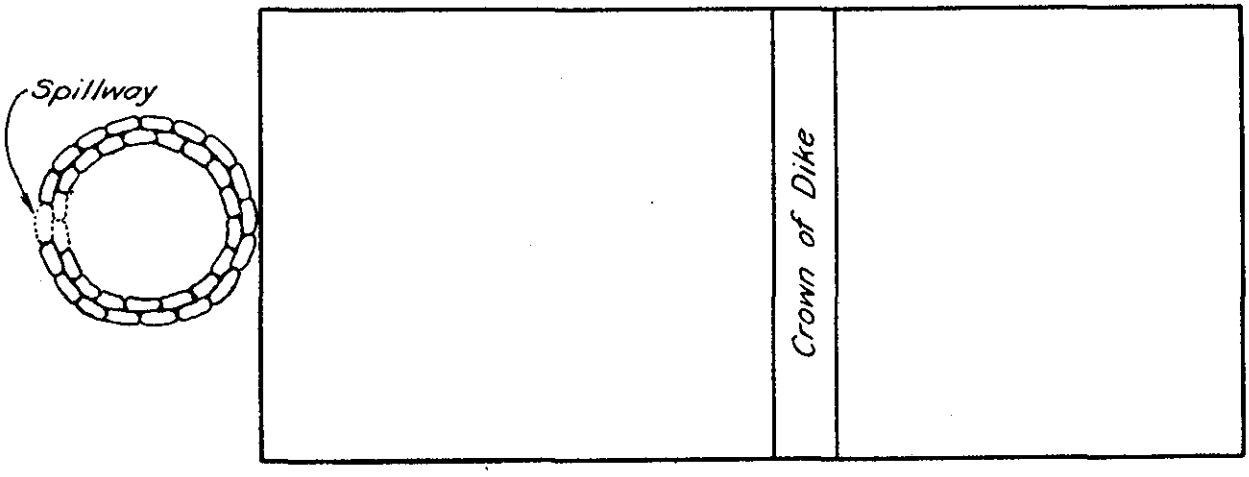
FLOOD EMERGENCY MEASURES
EFFECTS OF SAND BOILS

PLATE NO. I



ELEVATION

Wall should be built on firm foundation, with width of base at least 1½ times the height. Be sure to place sacks on ground clear of sand discharge. Tie into dike if boil is near toe.



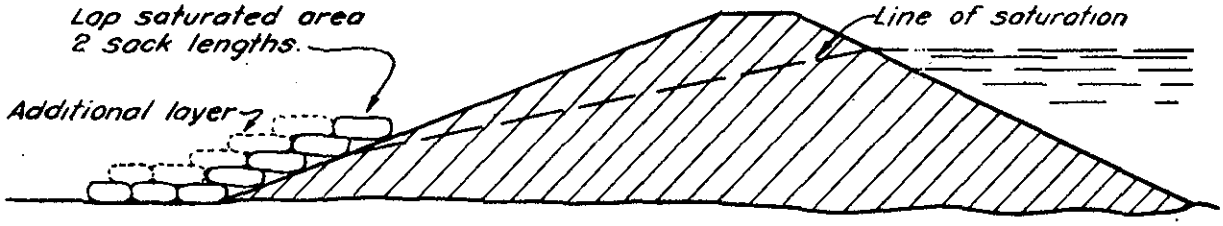
PLAN

Do not sack boil which does not put out material. Height of sack loop or ring should be only sufficient to create enough head to slow down flow through boil so that no more material is displaced and boil runs clear. Do not try to stop fully, flow through boil.

FLOOD EMERGENCY MEASURES

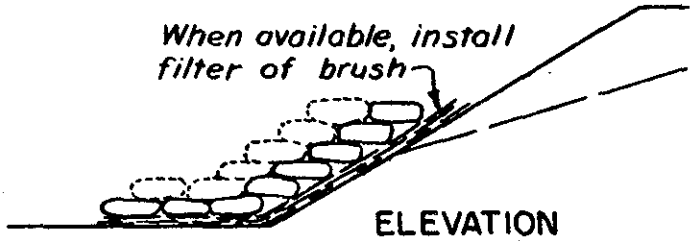
SAND BOIL

PLATE NO. II

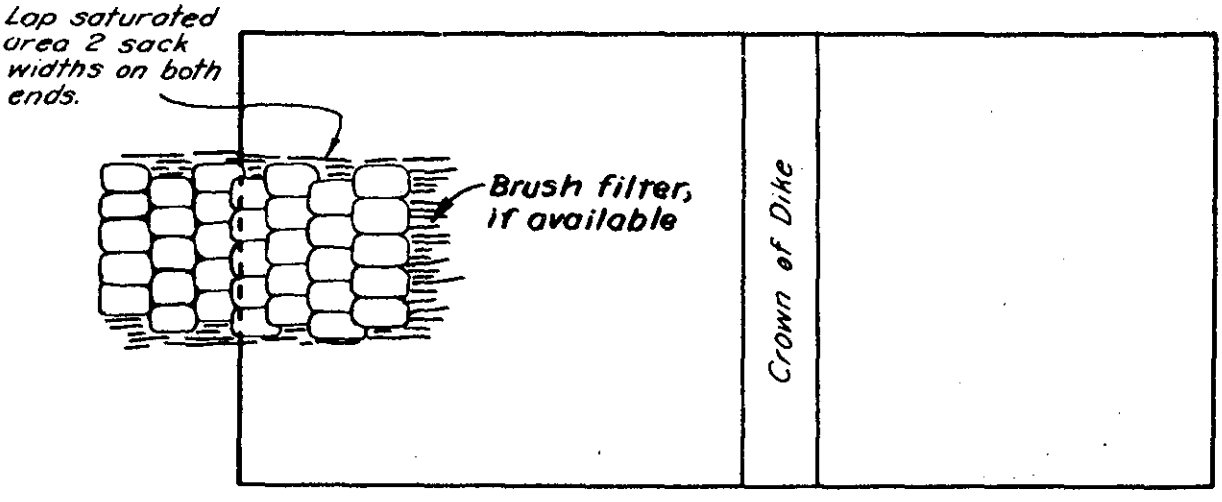


ELEVATION

Number of layers determined by velocity of seepage and amount of material being carried



ELEVATION



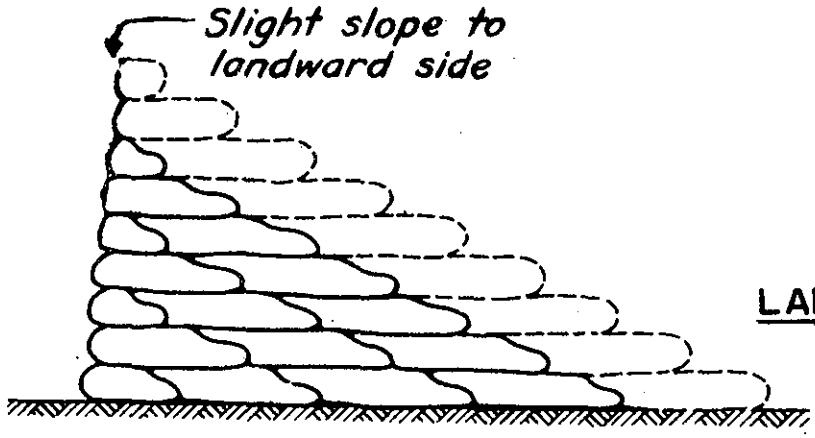
PLAN

Socks should be laid shingle fashion and not moulded into place.

FLOOD EMERGENCY MEASURES

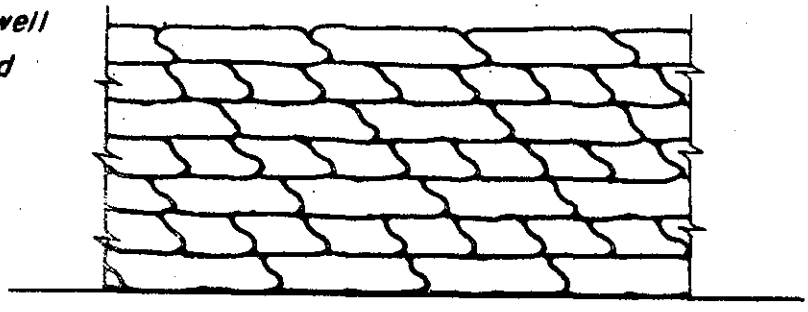
SACKING SLOUGHS

PLATE NO. III



SECTION

Note: Sacks should be lapped at least 1/3 all ways and well mauled or tamped into place.



RIVERSIDE ELEVATION

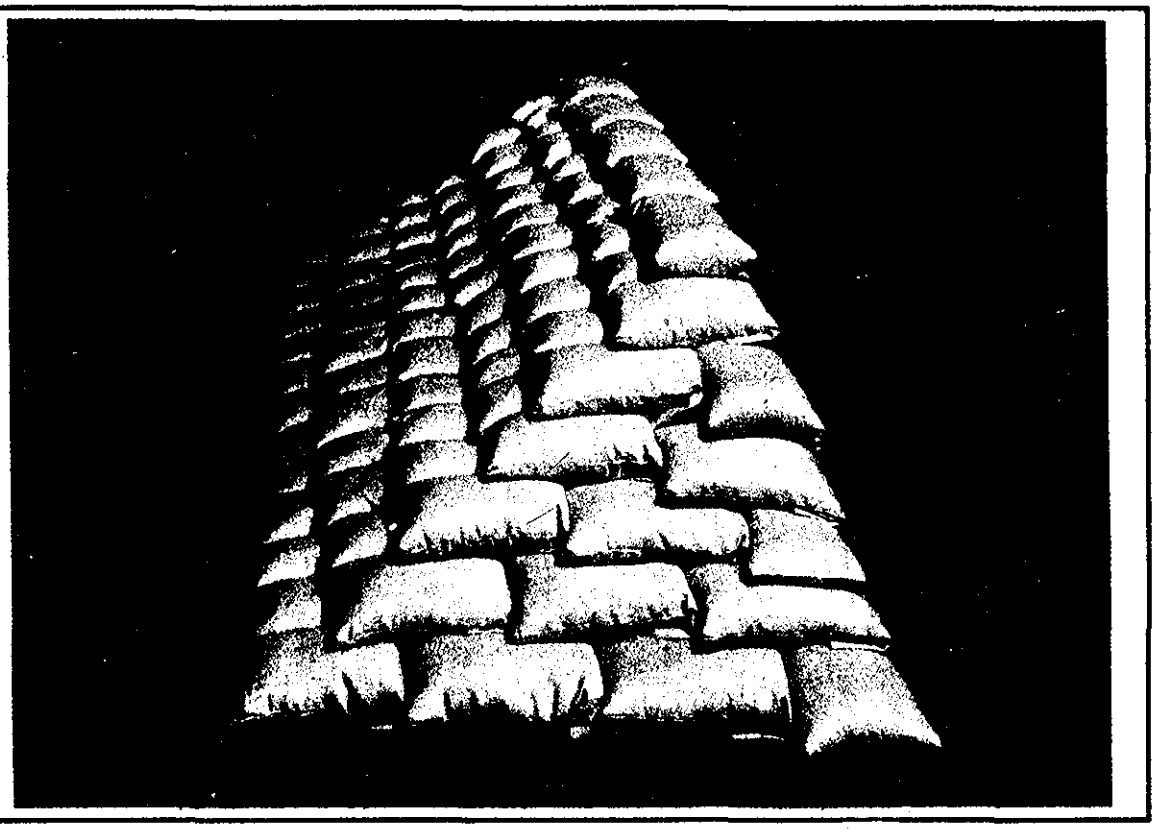
SACKS REQUIRED PER 100' STA.
100 lb. "Feed" Sacks - 1 Cu. Ft. Each

Approx. Hgt. Sack Dike	Sacks High	Required
1.5	3	300
2.0	4	750
3.0	6	1400
4.0	8	2250
5.0	10	3250
6.0	12	4500
7.0	14	5950
8.0	16	7600

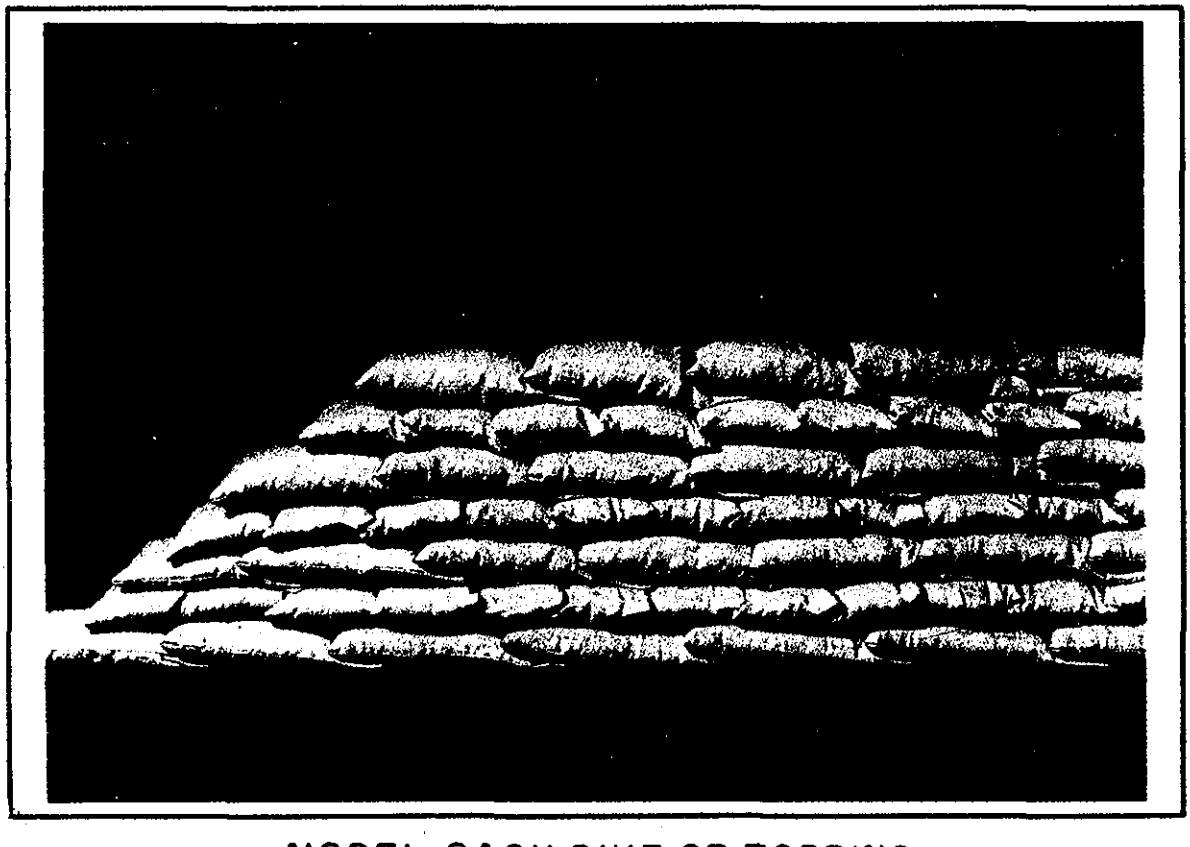
FLOOD EMERGENCY MEASURES

SACK DIKE OR TOPPING

PLATE NO. IV

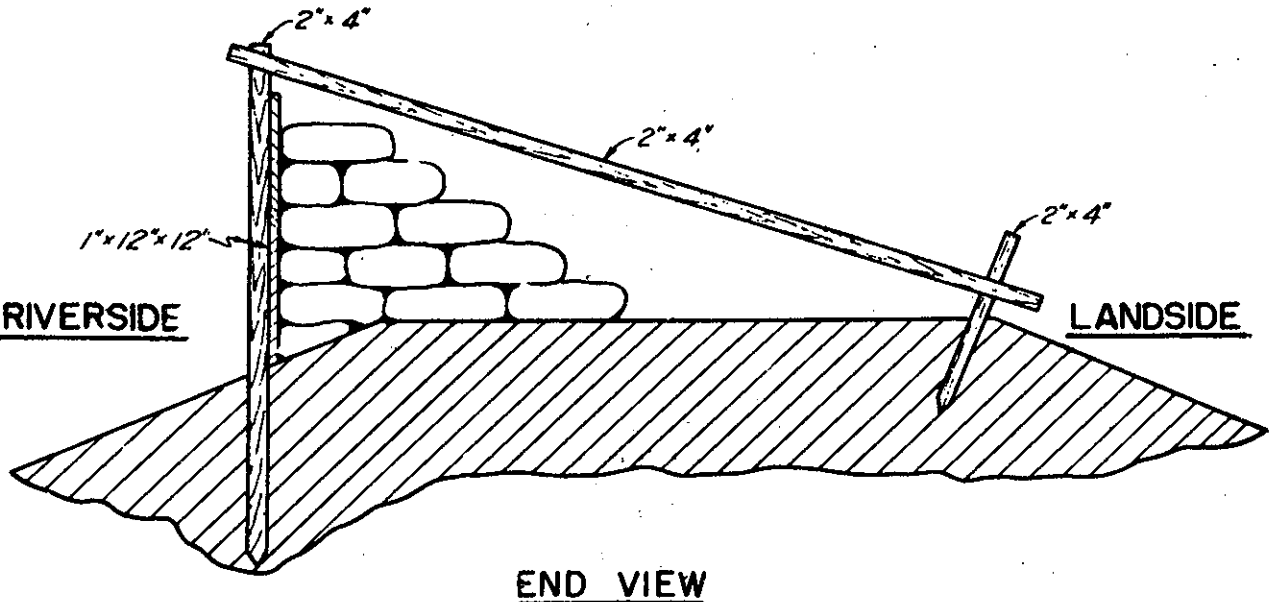


MODEL SACK DIKE OR TOPPING
Typical Section

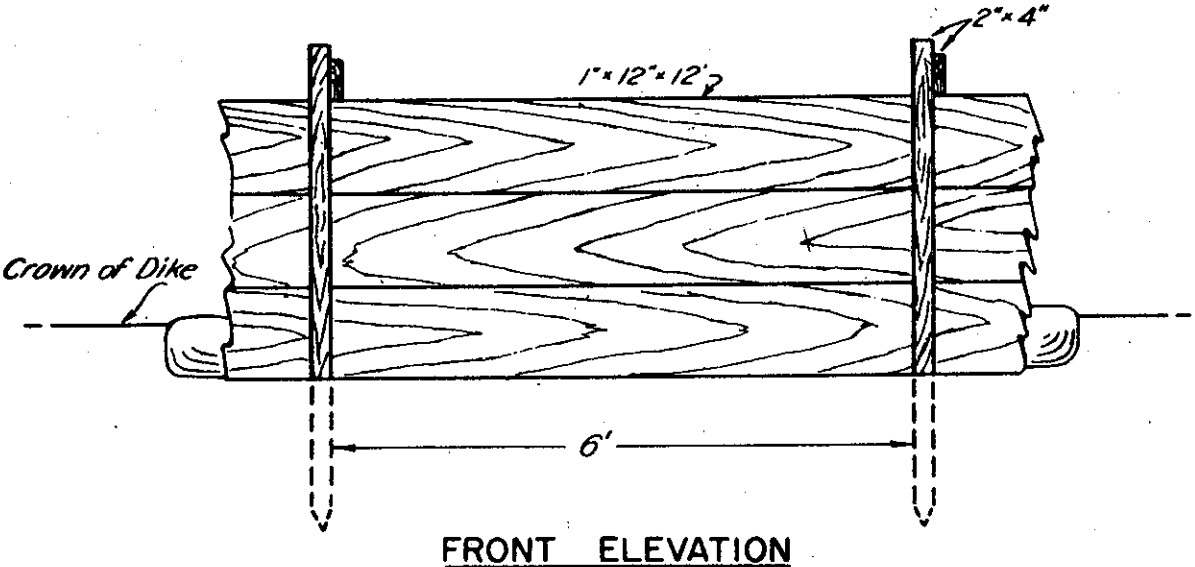


MODEL SACK DIKE OR TOPPING
Riverside View

PLATE NO. V



END VIEW



FRONT ELEVATION

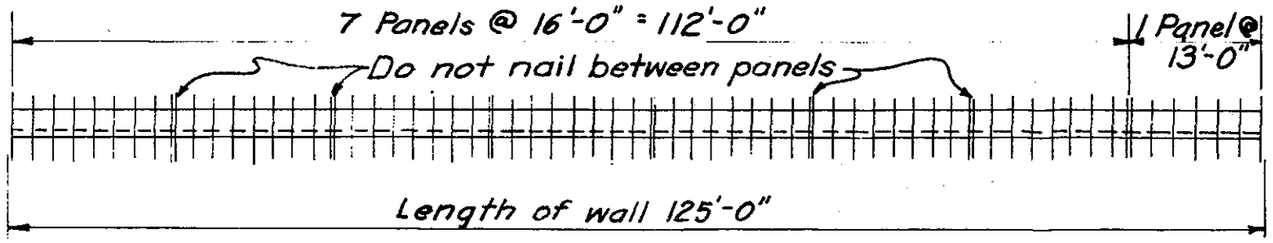
BILL OF MATERIAL TO CONSTRUCT 100 FEET

25 pcs. 1"x12"x12'	17 pcs. 2"x4"x6'
17 pcs. 2"x4"x10'	17 pcs. 2"x4"x2'

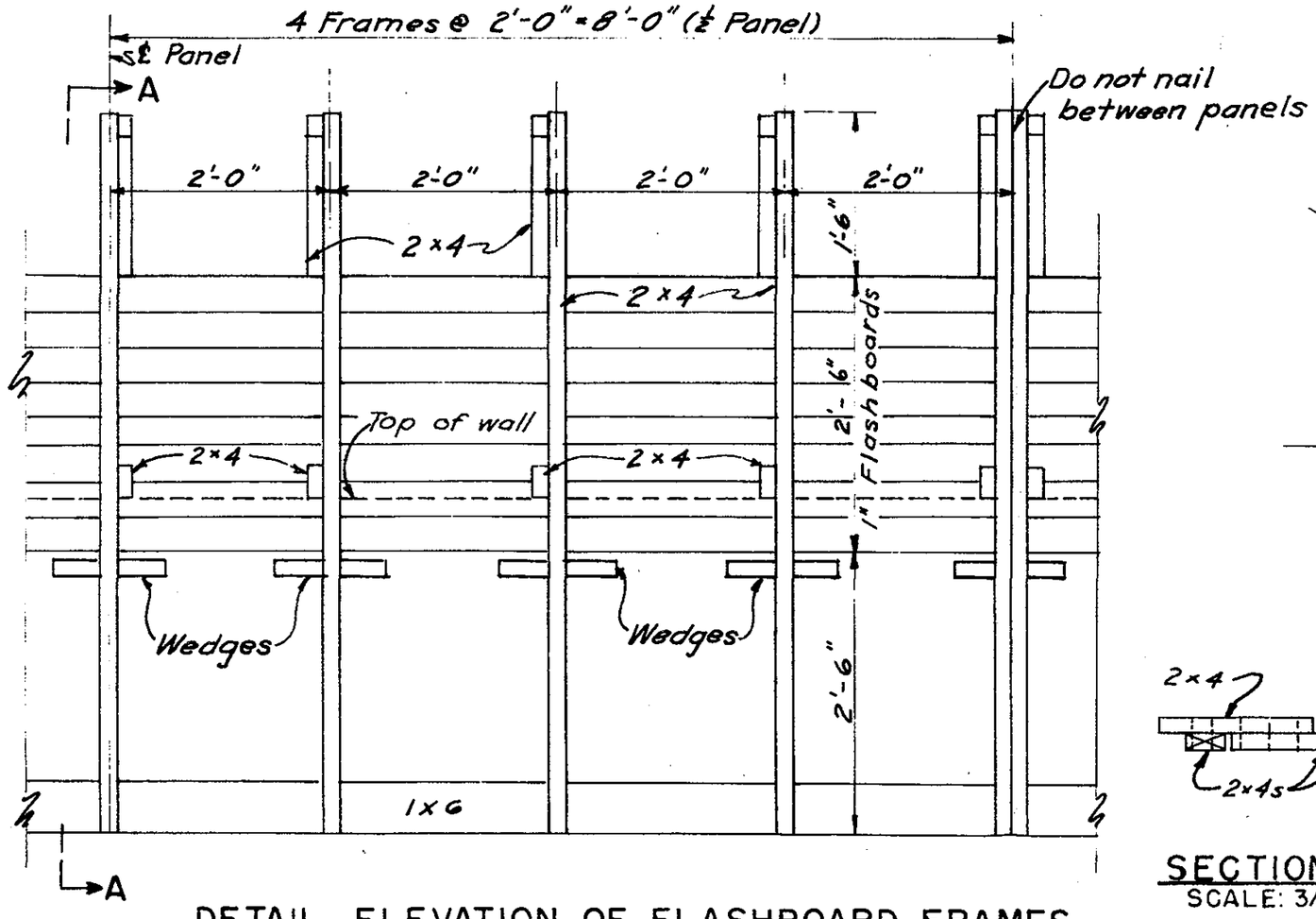
FLOOD EMERGENCY MEASURES

LUMBER AND SACK TOPPING

PLATE NO. VI

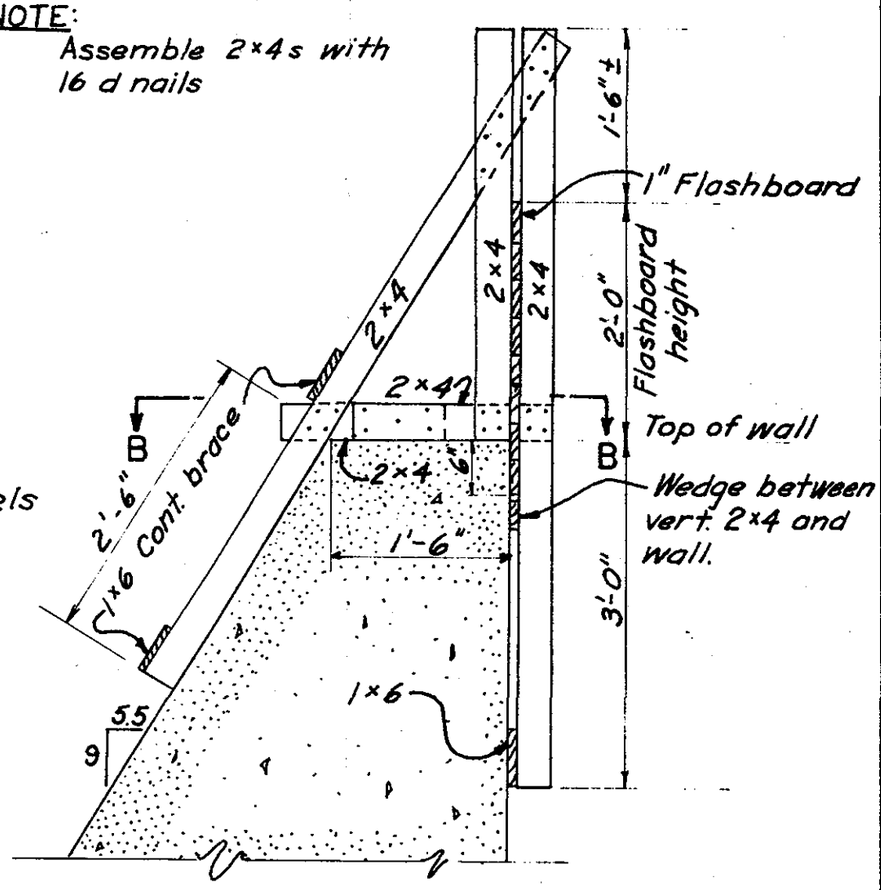


ELEVATION OF FLASHBOARDS
SCALE: 1/16" = 1'-0"

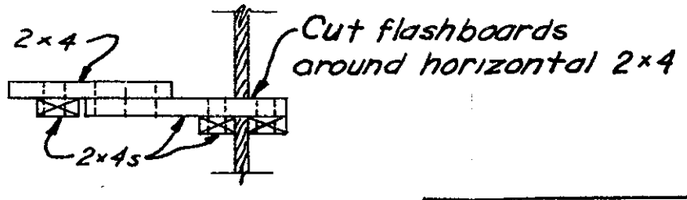


DETAIL ELEVATION OF FLASHBOARD FRAMES
SCALE: 3/4" = 1'-0"

NOTE:
Assemble 2×4s with 16 d nails



SECTION A-A
SCALE: 3/4" = 1'-0



SECTION B-B
SCALE: 3/4" = 1'-0

FLOOD EMERGENCY MEASURES

FLASHBOARDS

APPENDIX E

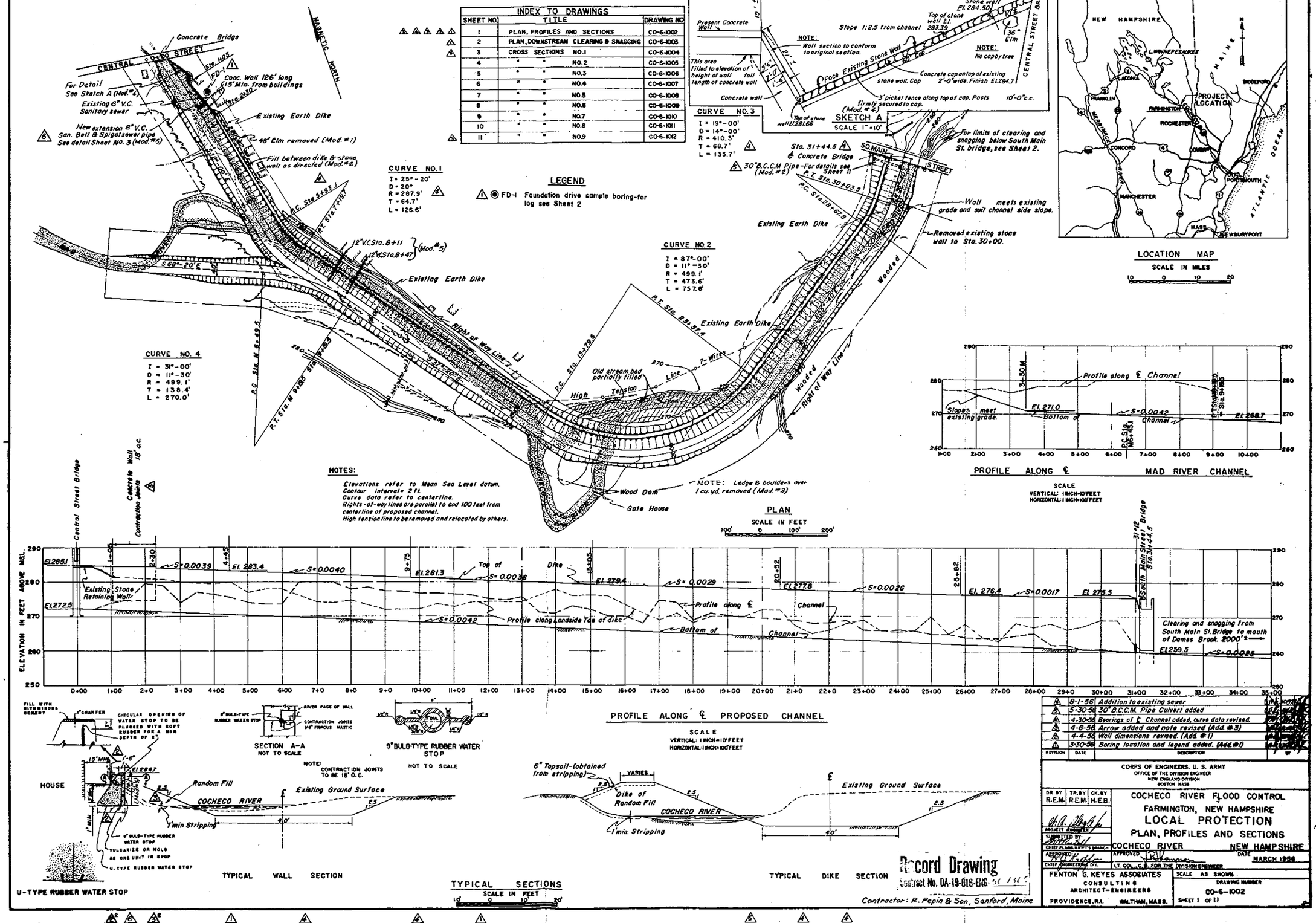
AS-BUILT DRAWINGS

Title	Plate No.
Plan, Profiles and Sections	I
Downstream Clearing and Snagging	II
Cross Sections Nos. 1 thu 9	III - XI

CORPS OF ENGINEERS

U. S. ARMY

INDEX TO DRAWINGS		
SHEET NO.	TITLE	DRAWING NO.
1	PLAN, PROFILES AND SECTIONS	CO-6-1002
2	PLAN, DOWNSTREAM CLEARING & SNAGGING	CO-6-1003
3	CROSS SECTIONS NO.1	CO-6-1004
4	" " NO.2	CO-6-1005
5	" " NO.3	CO-6-1006
6	" " NO.4	CO-6-1007
7	" " NO.5	CO-6-1008
8	" " NO.6	CO-6-1009
9	" " NO.7	CO-6-1010
10	" " NO.8	CO-6-1011
11	" " NO.9	CO-6-1012



REVISION	DATE	DESCRIPTION
5	8-1-56	Addition to existing sewer.
4	5-30-56	30" B.C.C.M. Pipe Culvert added
3	4-30-56	Bearings of ℄ Channel added, curve data revised.
2	4-6-56	Arrow added and note revised (Add.#3)
1	4-4-56	Wall dimensions revised. (Add.#1)
	3-30-56	Boring location and legend added. (Add.#1)

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON MASS.

DR. BY	TR. BY	CK. BY
R.E.M.	R.E.M.	H.E.B.

PROJECT ENGINEER
SUBMITTED BY: CHIEF PLANS & SPEC'S BRANCH
APPROVED: CHIEF ENGINEERING DIV.

COCHECO RIVER FLOOD CONTROL
FARMINGTON, NEW HAMPSHIRE
LOCAL PROTECTION
PLAN, PROFILES AND SECTIONS
COCHECO RIVER NEW HAMPSHIRE

APPROVED: LT. COL., C.E. FOR THE DIVISION ENGINEER
DATE: MARCH 1956

FENTON G. KEYES ASSOCIATES
CONSULTING ARCHITECT-ENGINEERS
PROVIDENCE, R.I. WALTHAM, MASS.

SCALE AS SHOWN
DRAWING NUMBER CO-6-1002
SHEET 1 OF 11

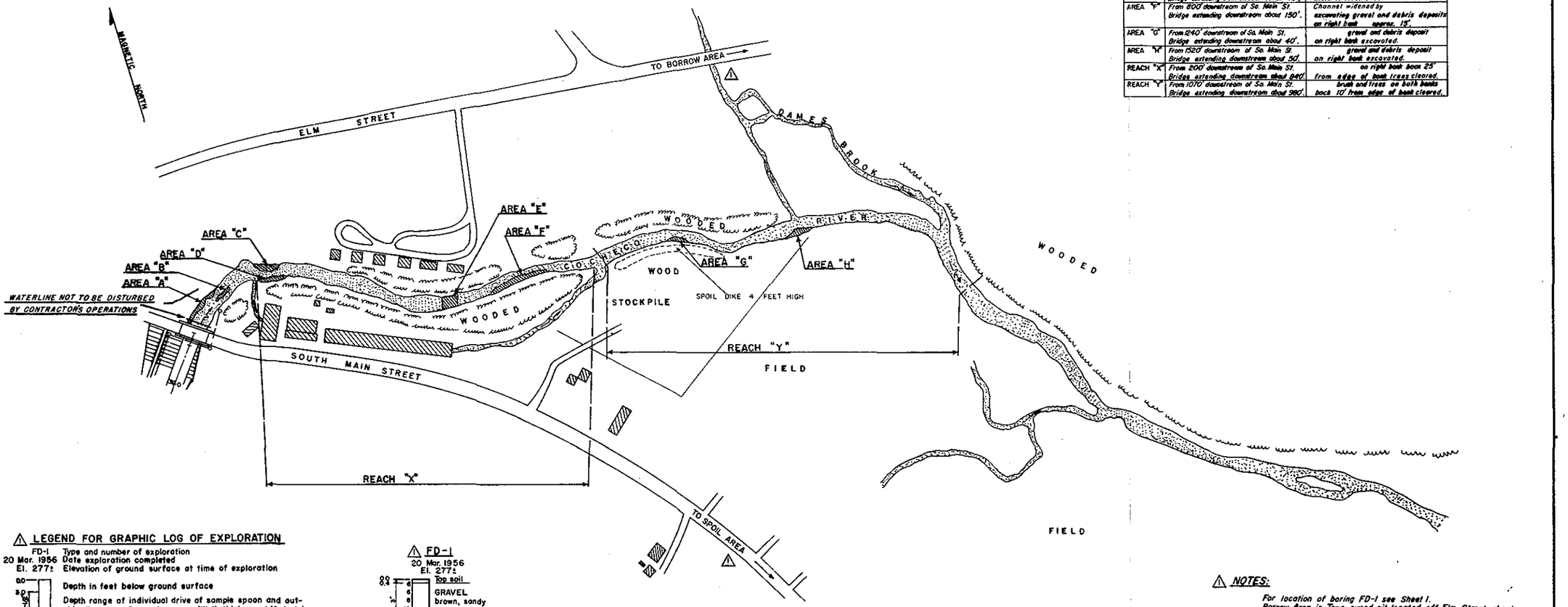
Record Drawing
Contract No. DA-19-016-ENG-56-134

Contractor: R. Pepin & Son, Sanford, Maine

CORPS OF ENGINEERS

U. S. ARMY

AREA	LOCATION	DESCRIPTION
AREA "A"	From So. Main St. Bridge to about 105' downstream.	Channel widened by excavating left bank approx. 10'.
AREA "B"	From 80' downstream of So. Main St. Bridge extending downstream about 50'.	Island excavated, trees cleared.
AREA "C"	From 200' downstream of So. Main St. Bridge extending downstream about 50'.	rock & boulder promontory on left bank removed.
AREA "D"	From 200' downstream of So. Main St. Bridge extending downstream about 75'	gravel and debris deposit on right bank excavated.
AREA "E"	From 670' downstream of So. Main St. Bridge extending downstream about 40',	gravel and debris shoal full width of river excavated.
AREA "F"	From 800' downstream of So. Main St. Bridge extending downstream about 150'.	Channel widened by excavating gravel and debris deposits on right bank approx. 15'.
AREA "G"	From 1240' downstream of So. Main St. Bridge extending downstream about 40'.	gravel and debris deposit on right bank excavated.
AREA "H"	From 1520' downstream of So. Main St. Bridge extending downstream about 50'.	gravel and debris deposit on right bank excavated.
REACH "X"	From 200' downstream of So. Main St. Bridge extending downstream about 940'	on right bank back 25' from edge of bank trees cleared.
REACH "Y"	From 1070' downstream of So. Main St. Bridge extending downstream about 980'.	brush and trees on both banks back 10' from edge of bank cleared.



PLAN

SCALE IN FEET

100' 0 100' 200'

⚠ LEGEND FOR GRAPHIC LOG OF EXPLORATION

FD-1 Type and number of exploration
20 Mar. 1956 Date exploration completed
El. 277± Elevation of ground surface at time of exploration

Depth in feet below ground surface

Depth range of individual drive of sample spoon and outside diameter of sample spoon. (Wall thickness 1/4-inch.)

Number of blows per foot of penetration using a 350 pound hammer falling freely an average of 18 inches on a solid sample spoon usually equipped with a beveled drive shoe. (see note #1)

Fractional foot of penetration indicated as follows: number of blows/Tenths of a foot (150/3).

NR No recovery or unsatisfactory soil samples recovered.

NS Not sampled (core-drilled, blasted and/or wash-bored).

Cobble or Boulder-(Core-Drilled)

Cobbles or boulders (continuous or nested). (Core-drilled and/or blasted and chopped.

GP Group symbol according to Unified Soil Classification System.

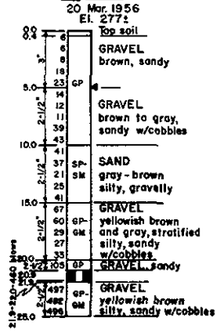
Subsurface water level at time of exploration. (See Note #2

NOTES

1. Normal length of continuous drive of sampling spoon is 5.0 feet. Penetration resistance of sampling spoon increases with length of drive, and blow counts, therefore, generally increase correspondingly except where distinct changes in material occur within the length of drive. In gravels, sands and gravels, and some glacial tills, the presence of coarse gravel, cobble or boulder sizes causes the blow count to become erratic, and therefore may not be indicative of the degree of compaction.

2. Water levels recorded during subsurface explorations seldom correspond with the natural level of free ground water, except in extensive and thick deposits of sands and gravels which are sufficiently pervious to permit rapid stabilization of water levels in the exploratory hole.

⚠ FD-1
20 Mar. 1956
El. 277±



⚠ NOTES:

For location of boring FD-1 see Sheet 1.
Borrow Area is Town-owned pit located off Elm Street about 1 mile from South Main Street bridge. Material is composed of mixed sands and gravels with minor amounts of finer materials.
Spoil Area is Town-owned dump located off Watson Cross Road about 2 miles from South Main Street bridge.

Record Drawing
Contract No. DA-19-018-ENG-56-1365

REVISION	DATE	DESCRIPTION	BY
⚠	9-30-56	Boring, Legend and Notes added. Borrow and Spoil Areas located. (Add. #1)	

CORPS OF ENGINEERS. U. S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

DR. BY	TR. BY	CK. BY
L.B.	L.B.	H.E.B.

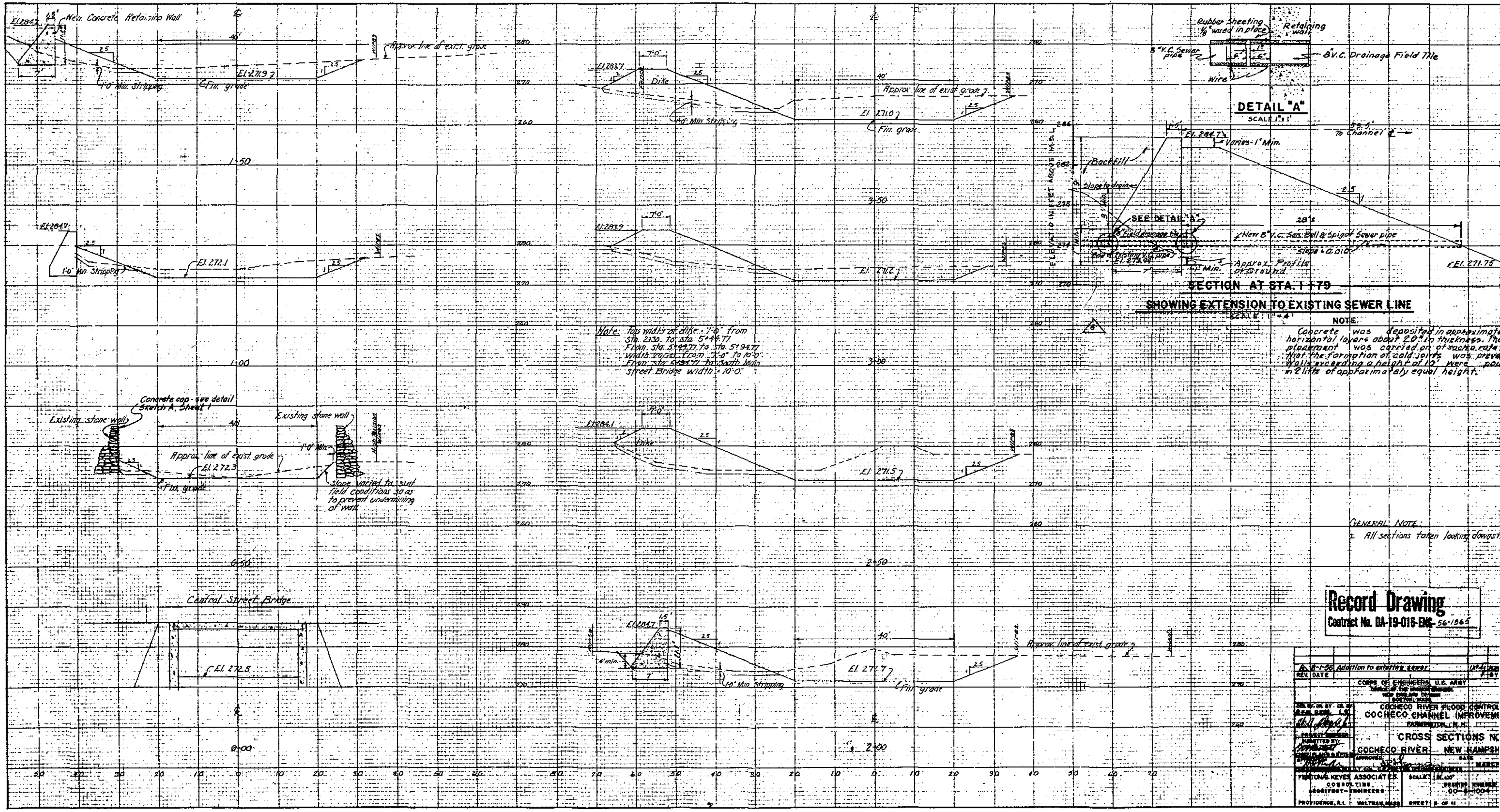
PROJECT ENGINEER
SUBMITTED BY
CHIEF PLANS & SPEC'S BRANCH
APPROVED
CHIEF ENGINEERING DIV.

COCHECO RIVER FLOOD CONTROL
FARMINGTON, NEW HAMPSHIRE
LOCAL PROTECTION
PLAN
DOWNSTREAM CLEARING & SNAGGING
COCHECO RIVER NEW HAMPSHIRE

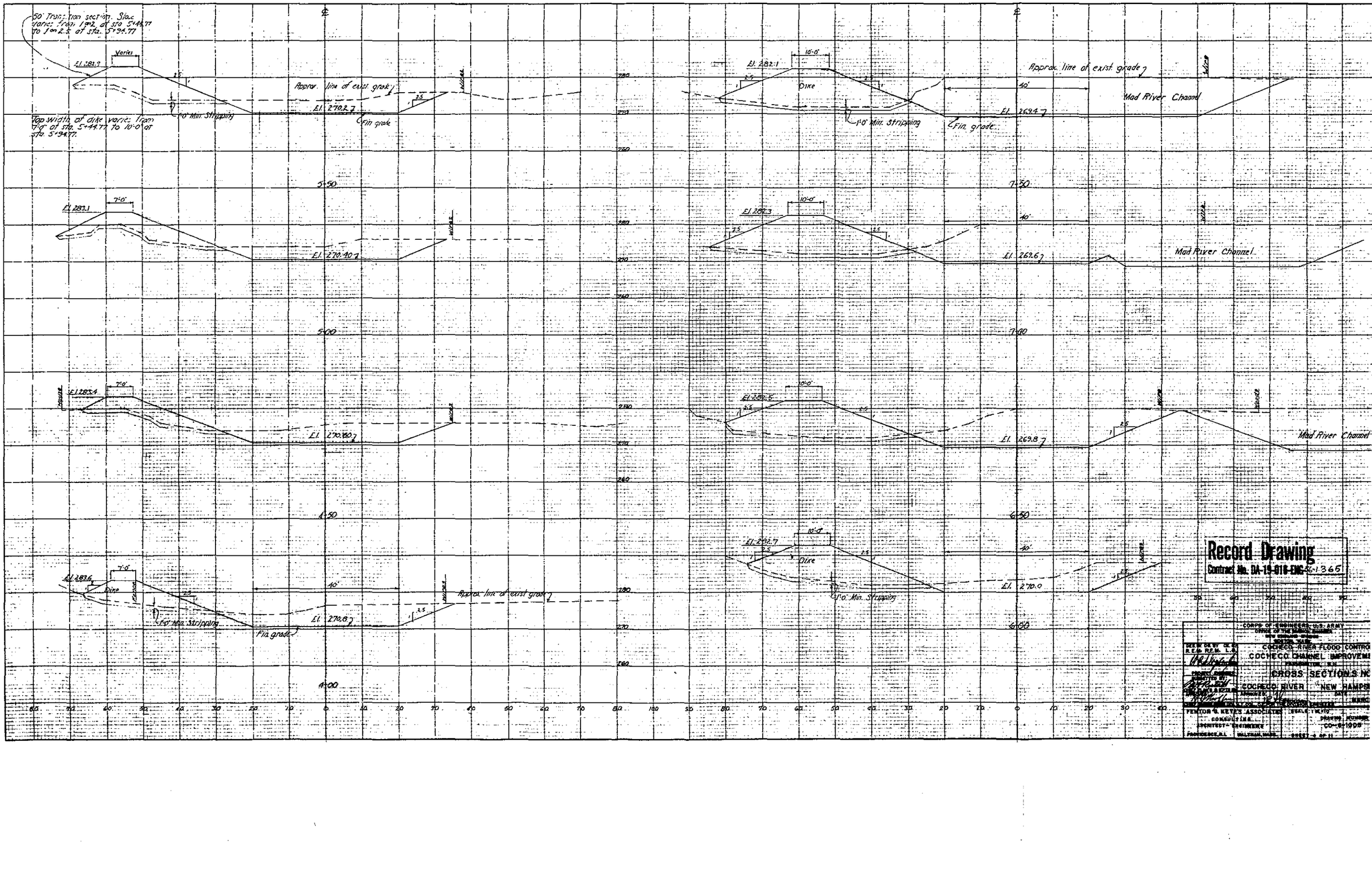
APPROVED DATE MARCH 1956
LT. COL., C.E. FOR THE DIVISION ENGINEER

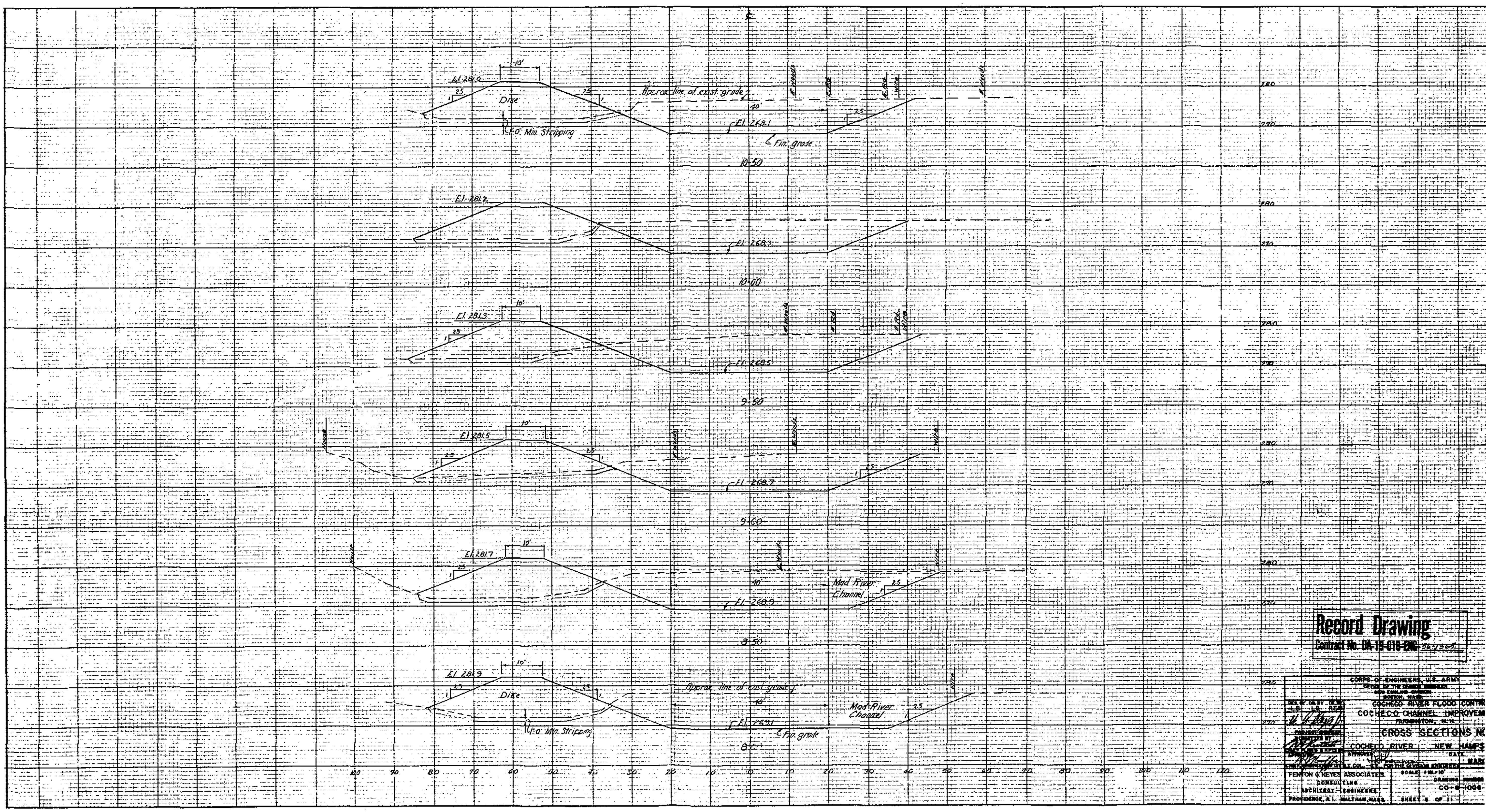
FENTON G. KEYES ASSOCIATES
CONSULTING
ARCHITECT-ENGINEERS
PROVIDENCE, R.I. WALTHAM, MASS.

SCALE AS SHOWN
DRAWING NUMBER
CO-6-1003
SHEET 2 OF 11

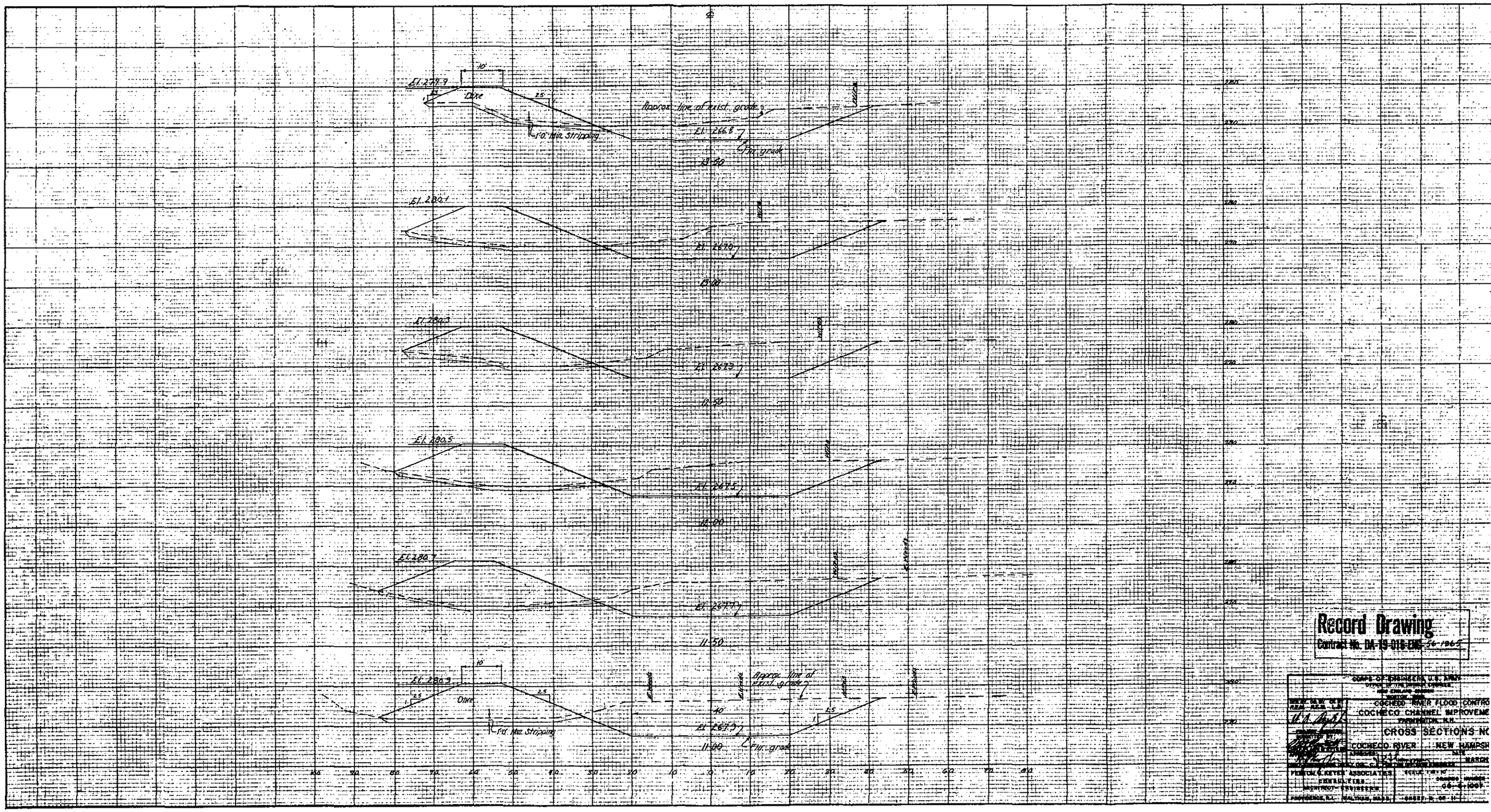


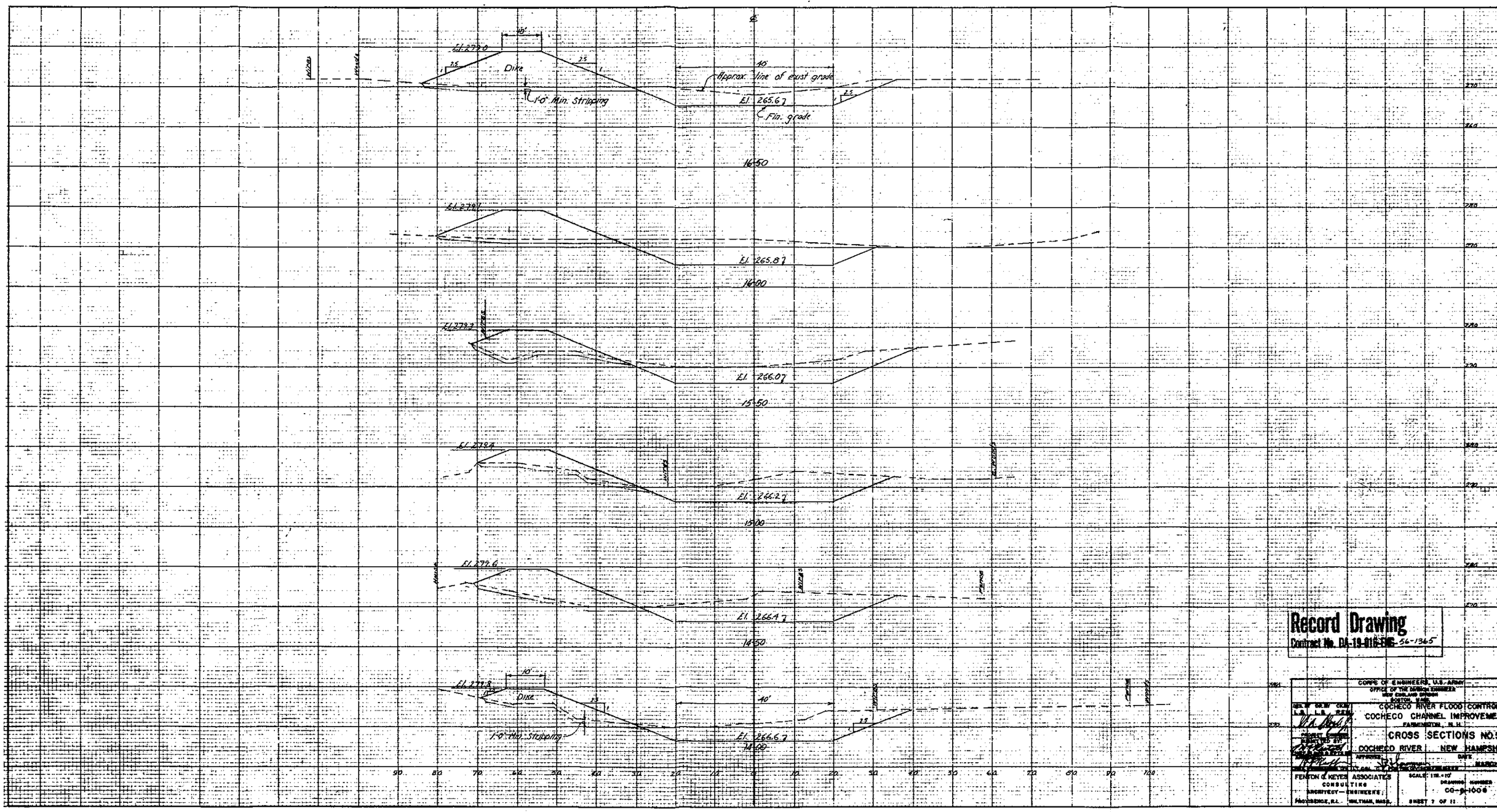
New Concrete Retaining Wall
El. 284.7
1.5'
7'
40'
2.5
Approx. line of exist. grade
El. 271.9
1'-0" Min. Stripping
Fin. grade
1+50
El. 284.7
El. 272.1
1'-0" Min. Stripping
1+00
Concrete cap - see detail Sketch A, Sheet 1
Existing stone wall
40'
Existing stone wall
1'-0" Min.
Approx. line of exist grade
El. 272.3
Fin. grade
Slope varied to suit field conditions so as to prevent undermining of wall
0+50
Central Street Bridge
El. 272.5
0+00
El. 283.7
7'-0"
Dike
40'
Approx. line of exist grade
El. 271.0
1'-0" Min Stripping
Fin. grade
3+50
El. 283.9
7'-0"
El. 271.2
Note: Top width of dike = 7'-0" from Sta. 2+30 to sta. 5+44.77. From sta. 5+44.77 to sta. 5+94.77 width varies from 7'-0" to 10'-0". From sta. 5+94.77 to South Main Street Bridge width = 10'-0".
3+00
El. 284.1
7'-0"
Dike
El. 271.5
2+50
El. 284.7
1.5'
4' min.
7'
40'
Approx. line of exist grade
El. 271.7
1'-0" Min Stripping
Fin. grade
2+00
Rubber Sheeting 1/8" wired in place
Retaining wall
8" V.C. Sewer pipe
8" V.C. Drainage Field Tile
Wire
DETAIL "A"
SCALE 1" = 1'
El. 284.7
Varies - 1' Min.
59.5' To Channel
Backfill
Slope to drain
SEE DETAIL "A"
8" Field drainage tile
28'±
New 8" V.C. San. Bell & Spigot Sewer pipe
Slope = 0.010
End of Existing V.C. pipe El. 273.99
1' Min.
Approx. Profile of Ground
El. 271.75
ELEVATION IN FEET ABOVE M.S.L.
SECTION AT STA. 1+79
SHOWING EXTENSION TO EXISTING SEWER LINE
SCALE: 1" = 4'
NOTE:
Concrete was deposited in approximate horizontal layers about 20" in thickness. The placement was carried on at such a rate that the formation of cold joints was prevented. Walls exceeding a height of 10' were poured in 2 lifts of approximately equal height.
GENERAL NOTE:
1. All sections taken looking downstream
Record Drawing
Contract No. DA-19-016-ENG-56-1365
8-1-56 Addition to existing sewer
REV. DATE
CORPS OF ENGINEERS, U.S. ARMY
COCHECO RIVER FLOOD CONTROL
COCHECO CHANNEL IMPROVEMENT
FARMINGTON, N.H.
CROSS SECTIONS
COCHECO RIVER NEW HAMPSHIRE
FENTON G. KEYES ASSOCIATES
CONSULTING ARCHITECT-ENGINEERS
PROVIDENCE, R.I. WALTHAM, MASS.


50' Transition section. Slope varies from 1 on 2 at sta. 5+49.77 to 1 on 2.5 at sta. 5+94.77
Varies
El. 281.9
Approx. line of exist. grade
El. 270.2
1'-0" Min. Stripping
Fin. grade
Top width of dike varies from 7'-0" at sta. 5+44.77 to 10'-0" at sta. 5+94.77.
5+50
El. 283.1
7'-0"
El. 270.4
5+00
El. 283.4
El. 270.7
4+50
El. 283.6
Dike
4'-0" Min. Stripping
40'
Approx. line of exist. grade
El. 270.8
4+00
El. 282.1
10'-0"
El. 269.4
Mad River Channel
7+50
El. 282.3
El. 269.6
7+00
El. 282.5
El. 269.8
6+50
El. 282.7
El. 270.0
6+00
Record Drawing
Contract No. DA-19-018-ENG-6-1365
CORPS OF ENGINEERS, U.S. ARMY
COCHECO RIVER FLOOD CONTRO
COCHECO CHANNEL IMPROVEM
CROSS SECTIONS NO
COCHECO RIVER NEW HAMPS
FENTON G. KEYES ASSOCIATES
CONSULTING
ENGINEERS - ARCHITECTS
PROVIDENCE, R.I. WALTHAM, MASS.
DRAWING NUMBER
CO-61-1905



El 281.0
10'
2.5
Dike
1.0' Min. Stripping
Approx line of exist grade
40'
El 268.1
Fin. grade
10+50
El 281.2
El 268.3
10+00
El 281.3
El 268.5
9+50
El 281.5
El 268.7
9+60
El 281.7
El 268.9
Mad River Channel
8+50
El 281.9
El 269.1
House
Woods
Wire
280
270
100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120
Record Drawing
Contract No. DA-19-016-ENG-56-7565
CORPS OF ENGINEERS, U.S. ARMY
COCHECO RIVER FLOOD CONTR
COCHECO CHANNEL IMPROVEM
FARMINGTON, N.H.
CROSS SECTIONS N
COCHECO RIVER NEW HAMPS
FENTON G. KEYES ASSOCIATES
CONSULTING
ARCHITECT - ENGINEERS
PROVIDENCE, R.I. WALTHAM, MASS.
CO-6-1006


El. 279.9
10
Dike
15
1'-0" Min. Stripping
Approx. line of exist. grade
El. 266.8
Fin. grade
13.50
El. 280.1
El. 267.0
13.00
El. 280.3
El. 267.3
11.50
El. 280.5
El. 267.5
11.00
El. 280.7
El. 267.7
11.50
El. 280.3
Dike
Std. Min. Stripping
Approx. line of exist. grade
El. 267.3
11.00
Fin. grade
Record Drawing
Contract No. DA-19-018-ENG-56-1965
CORPS OF ENGINEERS, U.S. ARMY
COCHECO RIVER FLOOD CONTRO
COCHECO CHANNEL IMPROVEME
CROSS SECTIONS NO
COCHECO RIVER NEW HAMPSH
PEIRCE & KEYES ASSOCIATES
CONSULTING ENGINEERS
CONSTRUCTION STRUCTURES
PROVIDENCE, R.I. WALTHAM, MASS.



Record Drawing

Contract No. DA-19-016-ENG-54-1345

CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.

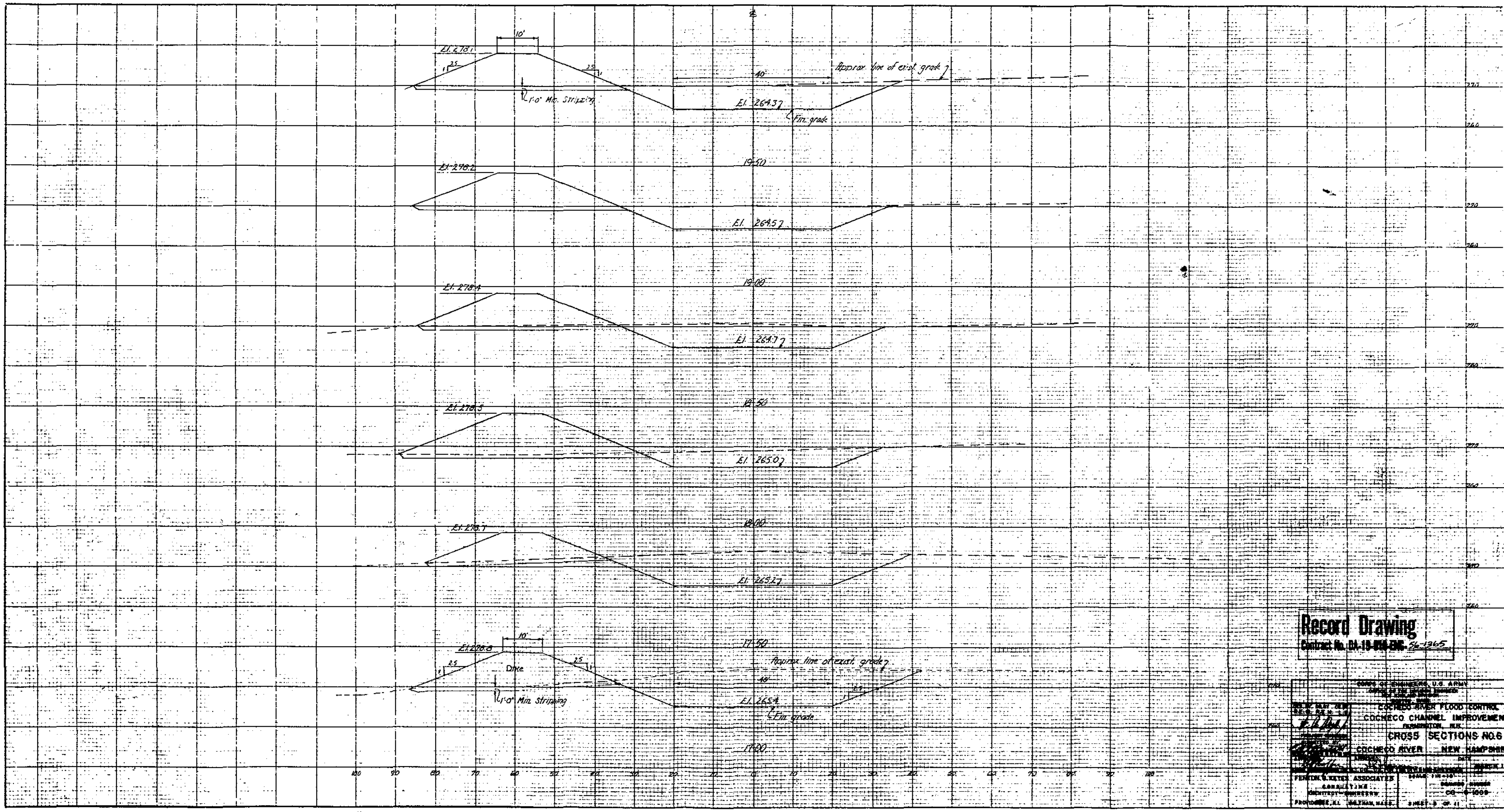
COCHECO RIVER FLOOD CONTRO
COCHECO CHANNEL IMPROVEME
FARMINGTON, N.H.

CROSS SECTIONS NO.
COCHECO RIVER, NEW HAMPSH

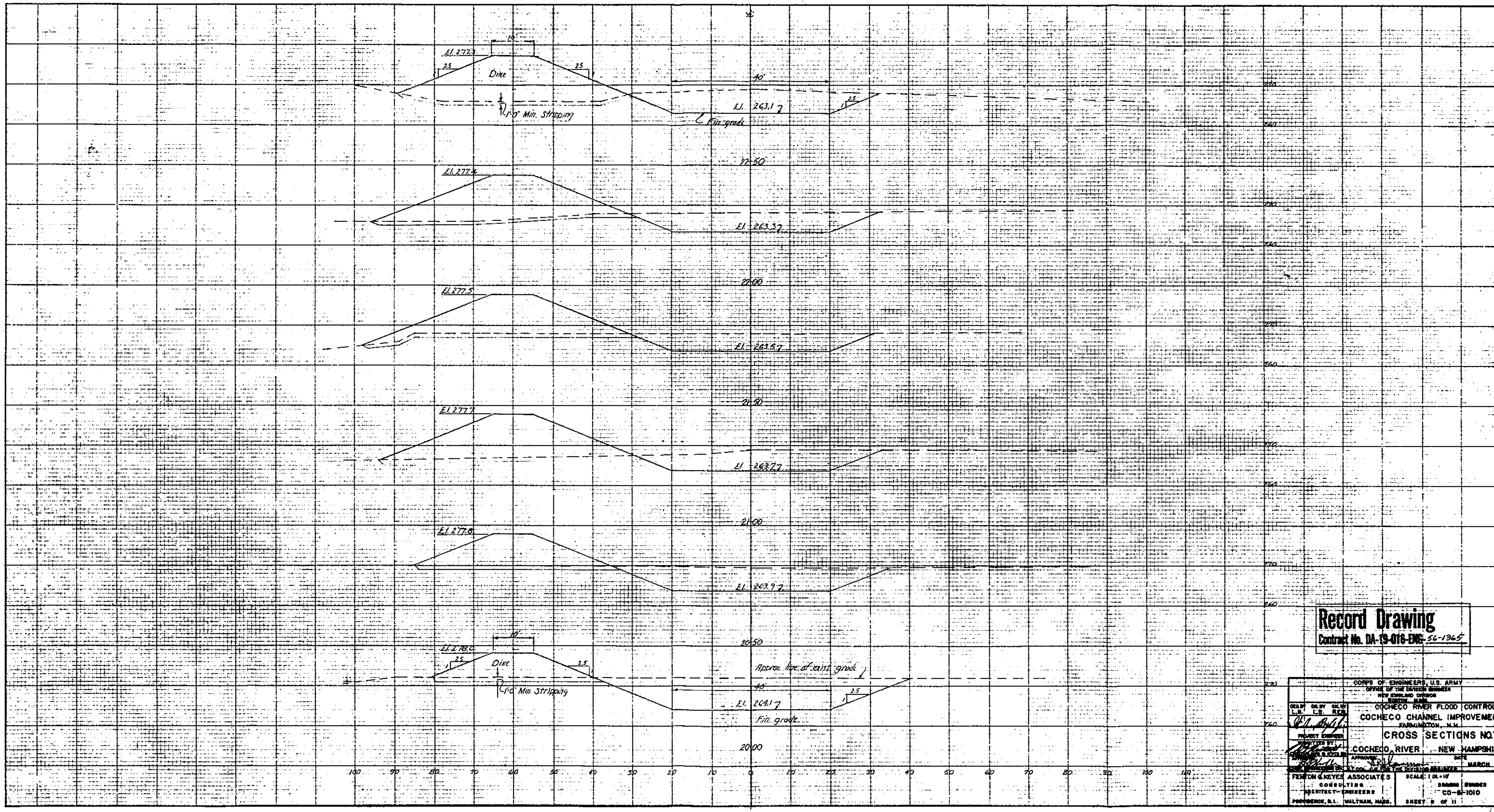
APPROVED: DATE:

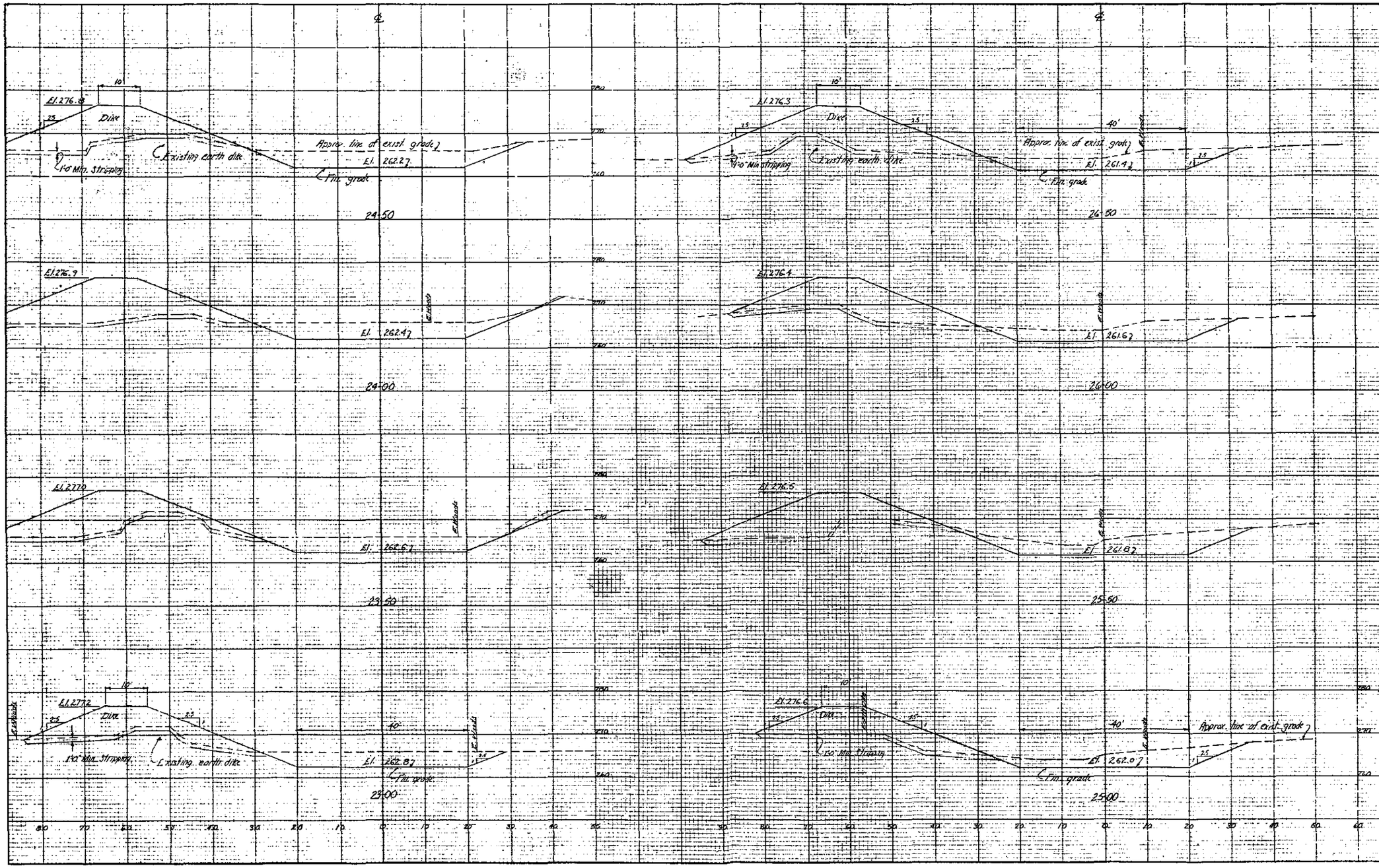
FENTON & KEYES ASSOCIATES
CONSULTING
ARCHITECT—ENGINEERS
PROVIDENCE, R.I. WALTHAM, MASS.

SCALE: 1 IN. = 10'
DRAWING NUMBER
CC-P-1006
SHEET 7 OF 11



10'
El. 278.1
2.5
1
1'-0" Min. Stripping
40'
Approx. line of exist. grade
El. 264.3
Fin. grade
19+50
El. 278.2
El. 264.5
19+00
El. 278.4
El. 264.7
18+50
El. 278.5
El. 265.0
18+00
El. 278.7
El. 265.2
17+50
El. 278.8
Dike
1'-0" Min. Stripping
Approx. line of exist. grade
40'
El. 265.4
Fin. grade
17+00
100
90
80
70
60
50
40
30
20
10
0
10
20
30
40
50
60
70
80
90
100
270
260
Record Drawing
Contract No. DA-19-016-ENG-56-1365
CORPS OF ENGINEERS, U.S. ARMY
COCHECO RIVER FLOOD CONTROL
COCHECO CHANNEL IMPROVEMENT
CROSS SECTIONS NO.6
COCHECO RIVER
NEW HAMPSHIRE
FENTON G. KEYES ASSOCIATES
CONSULTING
ARCHITECT-ENGINEERS
WALTHAM, MASS.


El. 277.3
10'
2.5
1
Dike
1'-0" Min. Stripping
40'
El. 263.1
Fin. grade
22+50
El. 277.4
El. 263.3
22+00
El. 277.5
El. 263.5
21+50
El. 277.7
El. 263.7
21+00
El. 277.8
El. 263.9
20+50
El. 278.0
Approx. line of exist. grade
El. 264.1
20+00
270
260
100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110
Record Drawing
Contract No. DA-19-016-ENG-56-1365
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.
DES. BY L.B. DR. BY L.S. CK. BY REB
PROJECT ENGINEER
SUBMITTED BY:
COCHECO RIVER FLOOD CONTRO
COCHECO CHANNEL IMPROVEME
FARMINGTON, N.H.
CROSS SECTIONS NO.
COCHECO RIVER NEW HAMPSHI
APPROVED:
LT. COL. C.E. FOR THE DIVISION ENGINEER
DATE MARCH
FENTON & KEYES ASSOCIATES
CONSULTING
ARCHITECT-ENGINEERS
PROVIDENCE, R.I. WALTHAM, MASS.
SCALE: 1 IN. = 10'
DRAWING NUMBER CO-6-1010
SHEET 9 OF 11



Record Drawing

Contract No. DA-19-016-ENG-56-1365

CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
WALTHAM, MASSACHUSETTS

COCHECO RIVER FLOOD CONTROL

COCHECO CHANNEL IMPROVEMENT

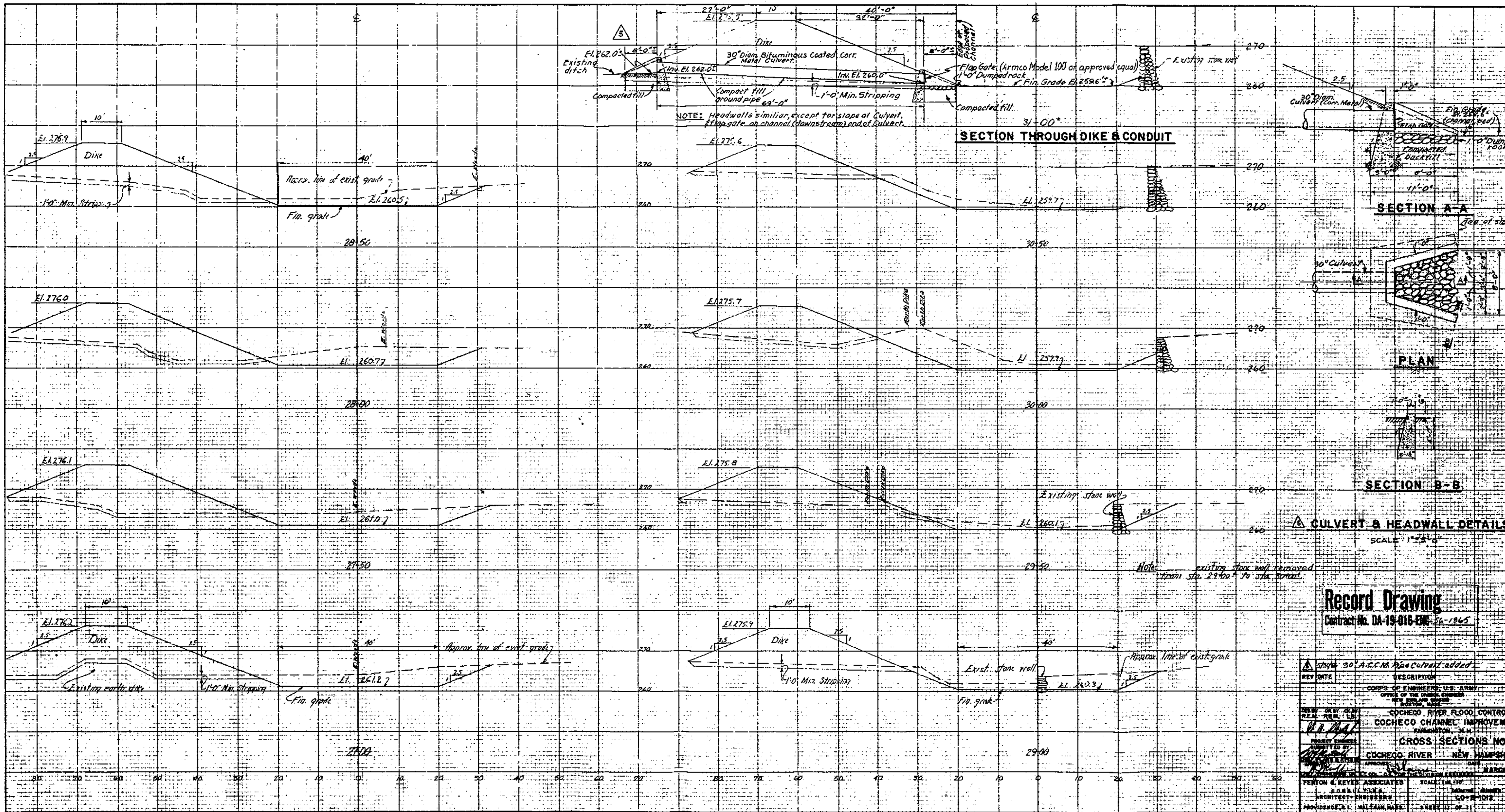
DURHAM, N.H.

CROSS SECTIONS NO.

COCHECO RIVER NEW HAMPSHIRE

FENTON & KEYES ASSOCIATES
CONSULTING
ARCHITECT - ENGINEERS
PROVIDENCE, R.I. WALTHAM, MASS.

CC-S-1091


SECTION THROUGH DIKE & CONDUIT
27'-0"
El. 275.5'
10'
40'-0"
32'-0"
Dike
El. 262.0'±
8'-0"±
Existing ditch
30" Diam. Bituminous Coated Corr. Metal Culvert.
Inv. El. 262.0'±
Inv. El. 260.0'
Compacted fill
Compact fill around pipe
69'-0"
1'-0" Min. Stripping
Edge of Proposed Channel
Flap Gate (Armco Model 100 or approved equal)
1'-0" Dumped rock
Fin. Grade El. 259.6'±
Existing stone wall
Compacted fill
NOTE: Headwalls similiar, except for slope at Culvert, & flap gate on channel (downstream) end of Culvert.
31+00±
El. 276.9
10'
Dike
40'
Approx. line of exist. grade
El. 260.5
1'-0" Min. Strip.
Fin. grade
28+50
El. 275.6
El. 259.7
30+50
El. 276.0
El. 260.77
28+00
El. 275.7
El. 257.7
30+00
El. 276.1
El. 261.0
27+50
El. 275.8
Existing stone wall
El. 260.1
29+50
Note: existing stone wall removed from sta. 29+00± to sta. 30+00±
El. 276.2
Dike
Approx. line of exist. grade
El. 261.2
Existing earth dike
1'-0" Min. Stripping
Fin. grade
27+00
El. 275.4
Dike
1'-0" Min. Stripping
Exist. stone wall
Approx. line of exist. grade
El. 260.3
Fin. grade
29+00
30" Diam. Culvert (Corr. Metal)
Fin. Grade El. 259.6 (channel bed)
Flap gate
1'-0" Dumped rock
Compacted backfill
5'-0"
6'-0"
11'-0"
SECTION A-A
Toe of slope
30" Culvert
PLAN
SECTION B-B
CULVERT & HEADWALL DETAILS
SCALE: 1" = 5'-0"
Record Drawing
Contract No. DA-19-016-ENG-56-1965
5 | 5/24/66 | 30" A.C.C.M. Pipe Culvert added
REV | DATE | DESCRIPTION
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
BOSTON, MASS.
COCHECO RIVER FLOOD CONTROL
COCHECO CHANNEL IMPROVEMENT
FARMINGTON, N.H.
CROSS SECTIONS NO.
COCHECO RIVER
NEW HAMPSHIRE
FENTON G. KEYES ASSOCIATES
CONSULTING ARCHITECT-ENGINEERS
PROVIDENCE, R.I.
WALTHAM, MASS.
SCALE: 1 IN. = 10'
CO-R-1012
PROJECT ENGINEER
SUBMITTED BY
APPROVED
LT. COL. C.E. FOR THE DIVISION ENGINEER
MARCH